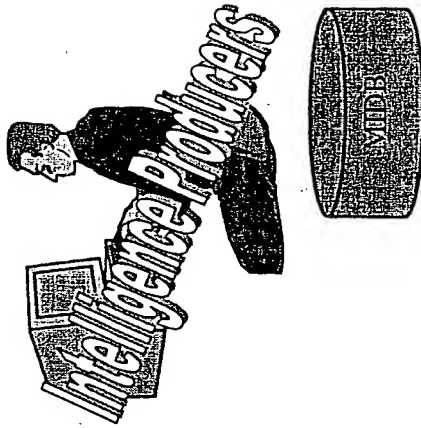
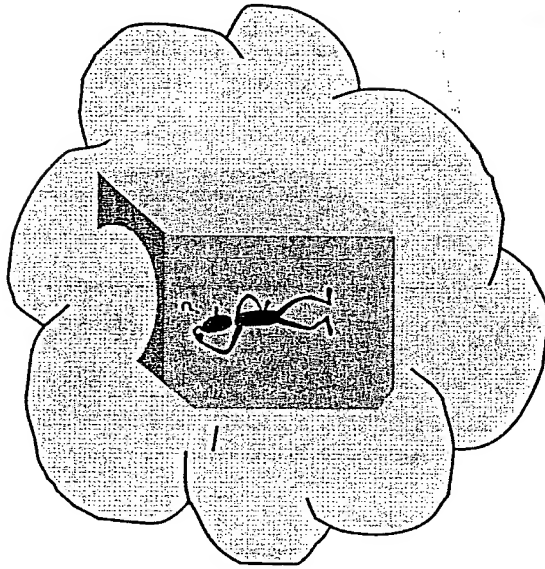
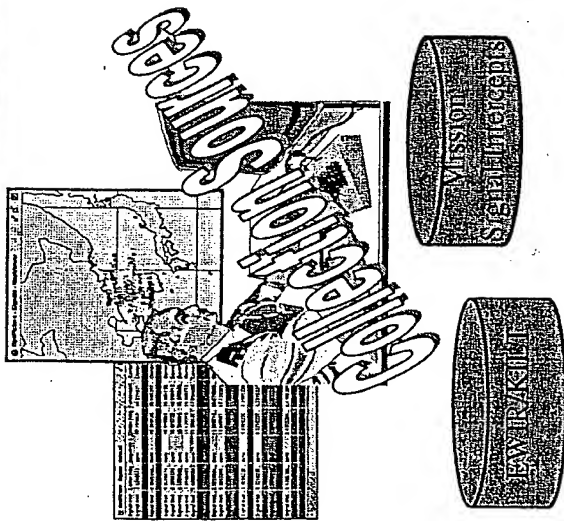
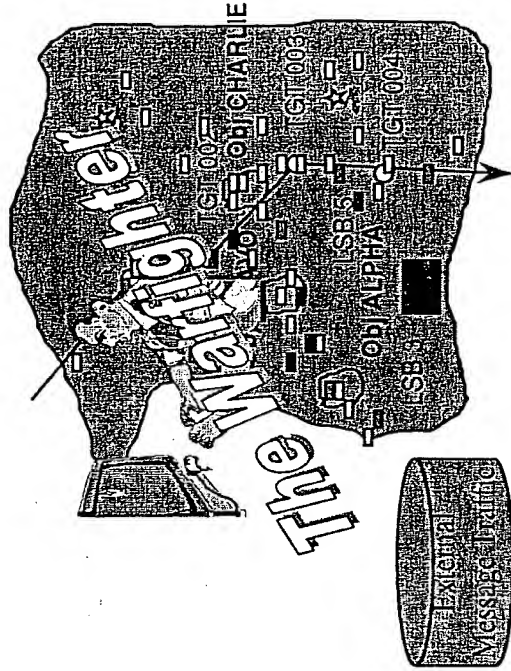


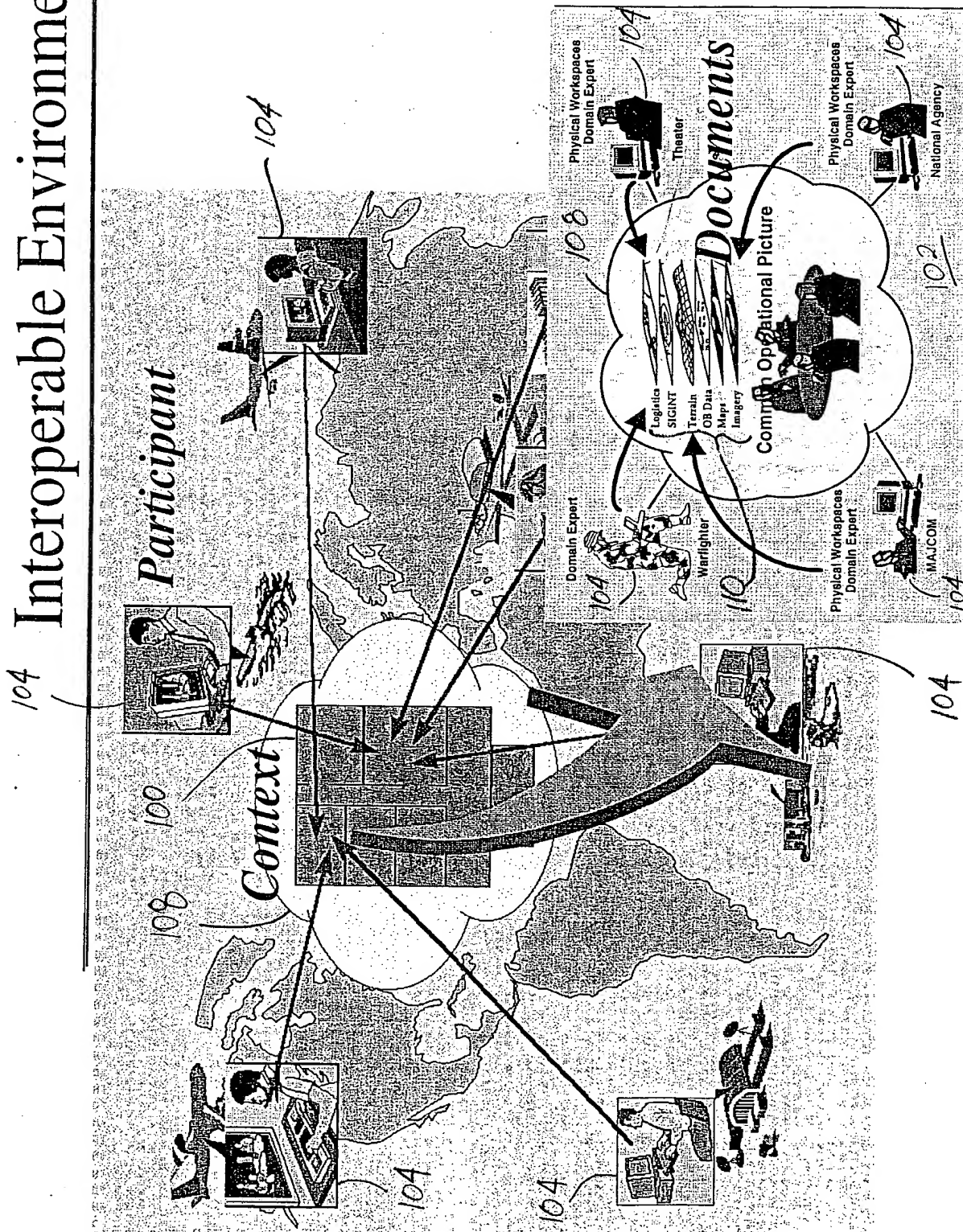
# TODAY



- Tools restricted to a specific data source
- Difficulty in analyzing data from various data sources using common tools
- Stove-Pipe systems that are costly to enhance
- Inability to collaborate on multiple data sources at the same time to solve a problem

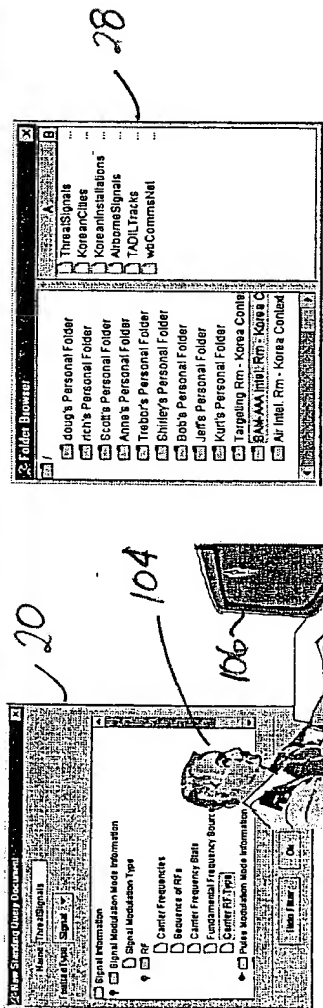


# Collaborative Interoperable Environment



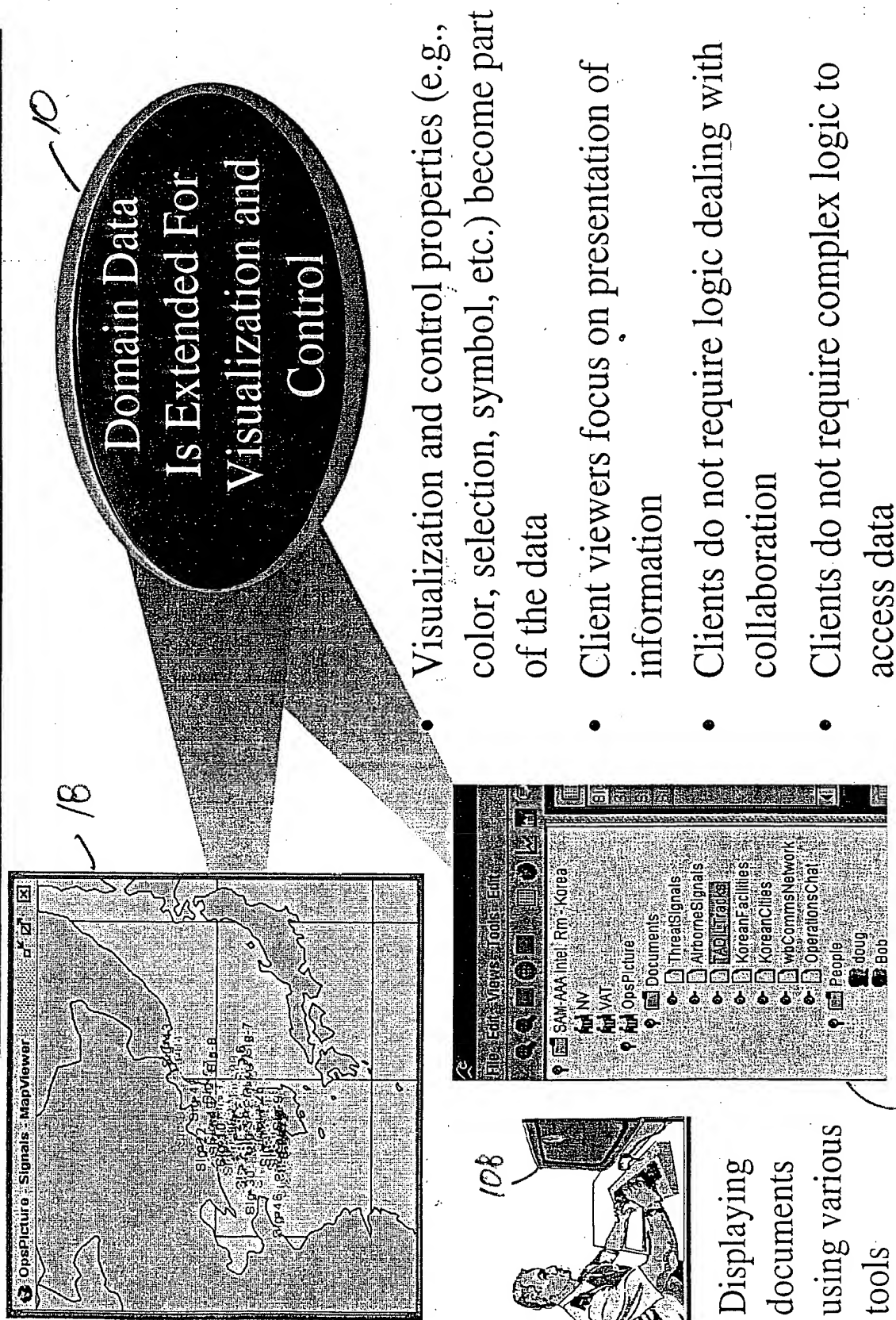
Conference

# “Document” based data manipulation



- A Document represents a collection of data
- Documents may be created by querying a data source
  - Standing queries are constantly evaluated
  - Static queries represent the state of the data source at the time the query was initiated
- Documents may initially be empty and populated through user or agent actions
- Documents are placed in conferences to be manipulated using the tools that best solve the problem.

# Thin Clients interact with data represented by a document



Visualization and control properties (e.g., color, selection, symbol, etc.) become part of the data

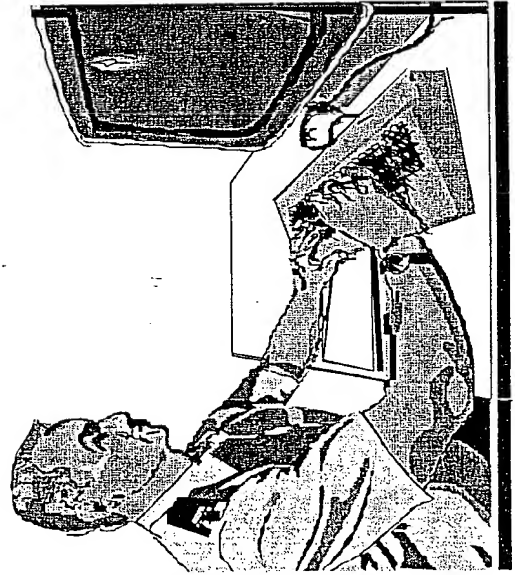
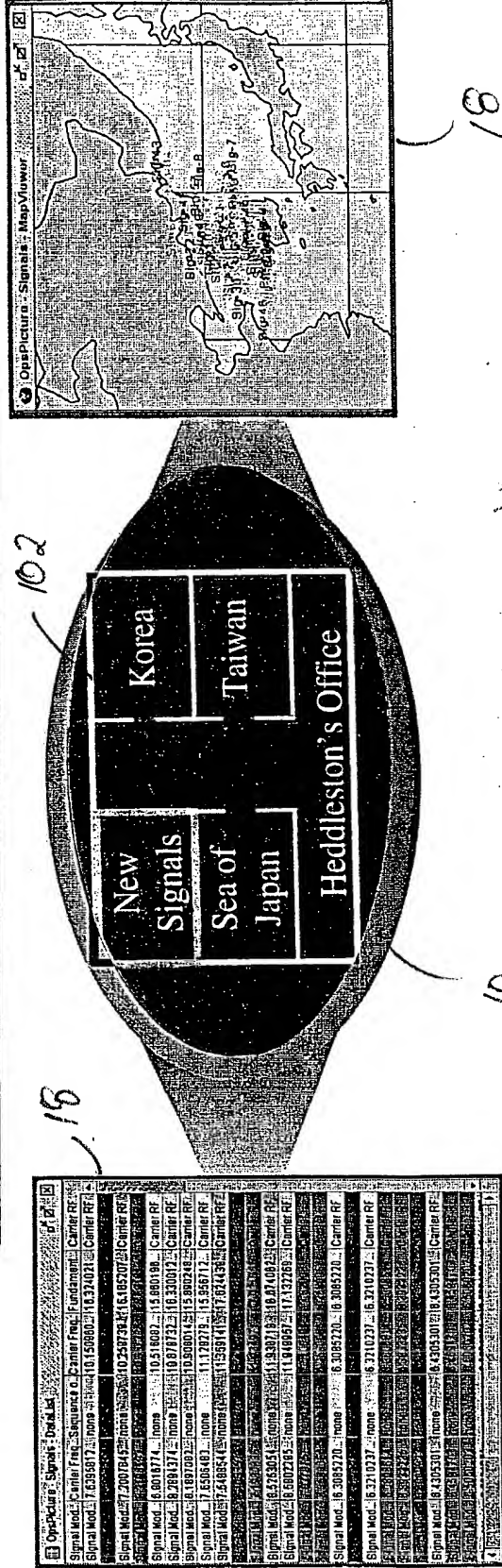
- Client viewers focus on presentation of information
- Clients do not require logic dealing with collaboration
- Clients do not require complex logic to access data

Clients do not require logic dealing with collaboration

Clients do not require complex logic to access data

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# Collaboration on Multiple Views



- Single user collaboration
- Multiple tools in the same conference coordinate visualization (e.g. highlight, color)
- All tools in a conference cooperate for problem solving
- No tool-to-tool communication

[illegible]

- Framework provides inherent multi-user collaboration capability
- Analysts need different tools to perform their duties. Framework supports collaboration between them
- No separate “paste to whiteboard” action needed for collaboration
- Collaboration boundary is the Place, which may contain one or more conferences
- Collaborators may be agents as well as humans

# Collaboration Summary

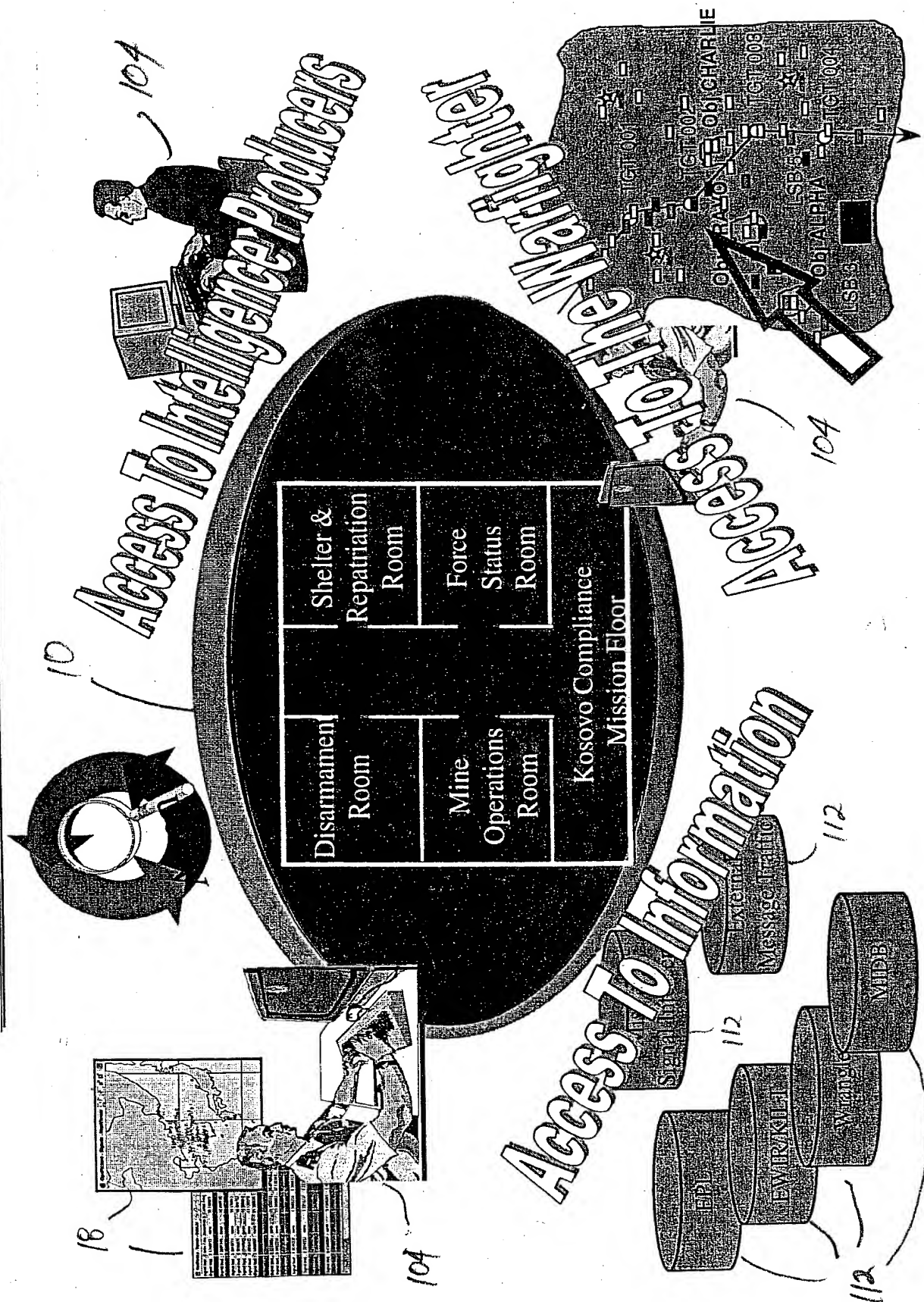


Fig. 7

# Architectural Strategy

## Key Reference Architectures

- Object Management Architecture (OMA)
  - OpenGIS, CosServices
- COE Layered Architecture
- UCA Cryptologic Framework
- USIGS
  - GIAS

## Key Data Models

- SOM, MIDB, JCDB, ASAS, L245, ECDS, TEXTA

## Architectural Patterns

- Layered Architecture
- Data Centric Architecture
  - Information Management Framework
  - Interactive Analysis Framework
- Mission Management Architecture
  - Task Management Framework
  - Resource Management Framework

## COTS SW Infrastructure

- JAVA/C++
- CORBA
- Enterprise Java Beans
- RDBMS/ODBMS
- Microsoft Windows
- WEB Server/Browser
- XML / DOM

## COTS HW

- UNIX SMP Server
- NT Workstations

# Services Based Architecture

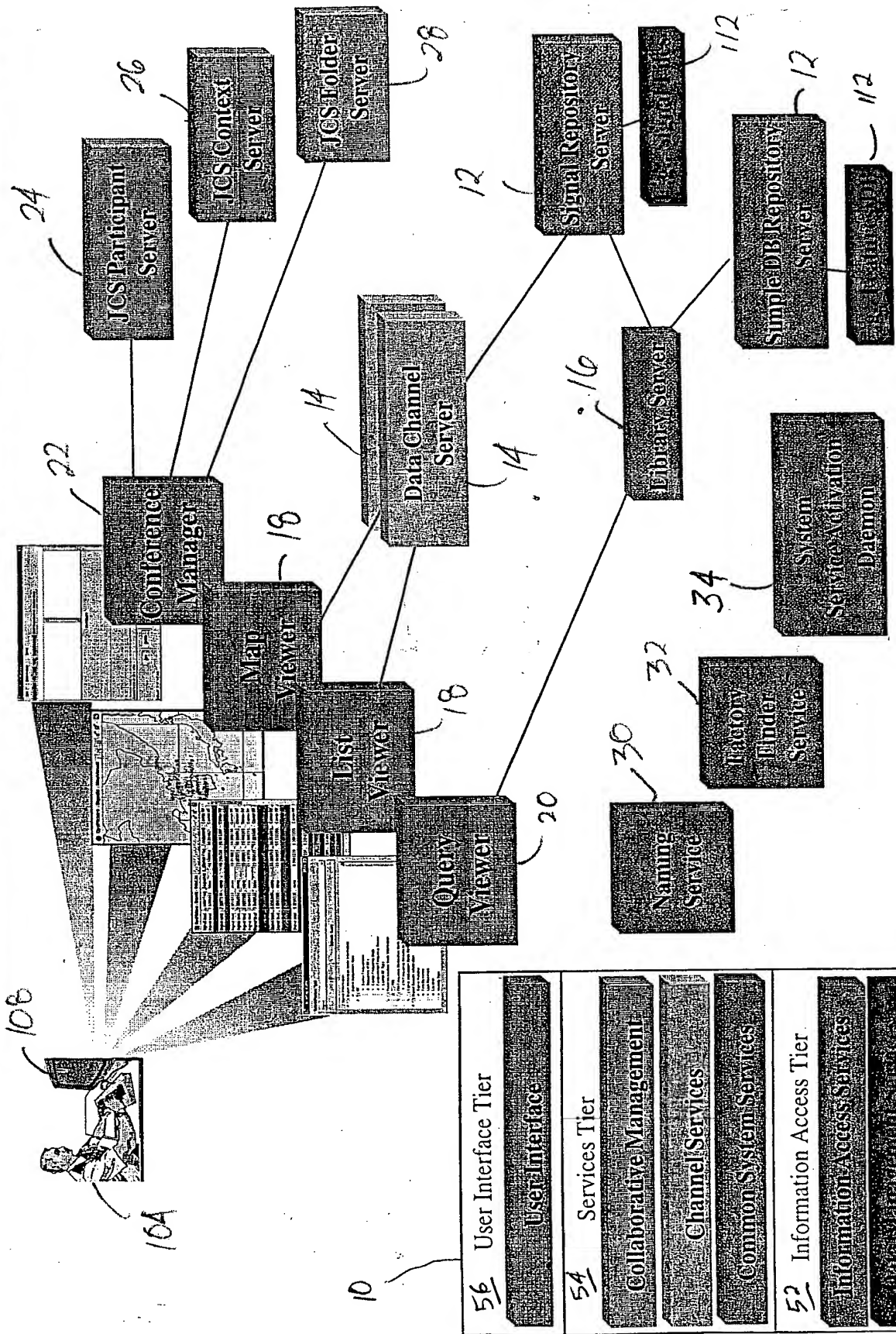


Fig. 9

FIG. 10 is a block diagram of the system architecture of the present invention.

# Extending The Infrastructure

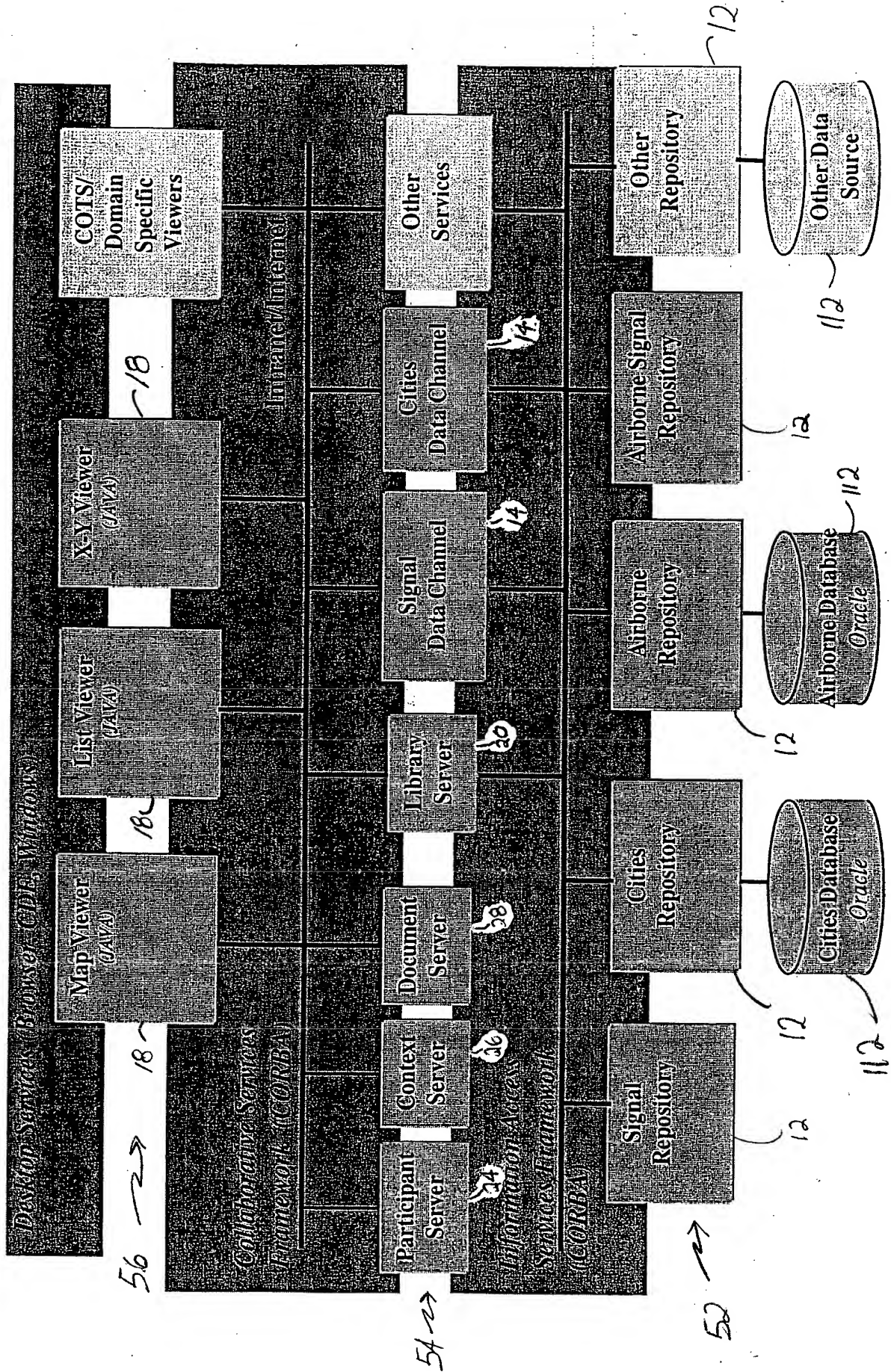
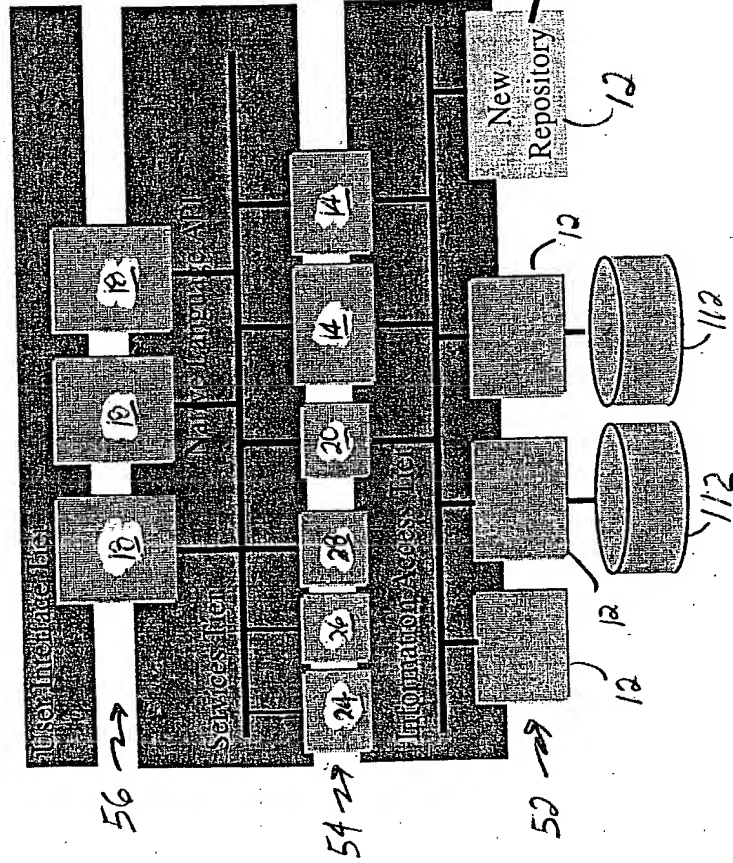


Fig. 10

# Integration with legacy systems

## Minimum Level Integration

10



202

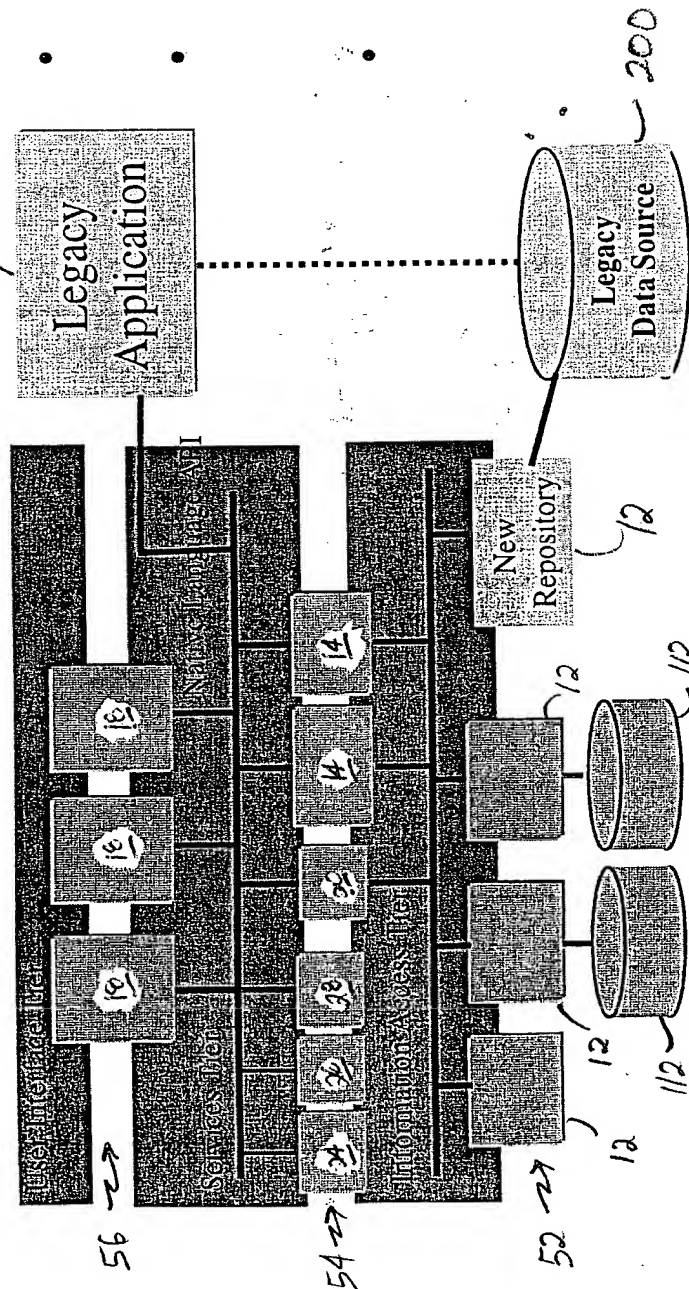
SYSTEM Infrastructure Legacy System

- Provide access to legacy data source through a new repository
- No legacy software changes required
- New data source is available for collaborative processing
- Provides new options for extending system capabilities
- Low/No Risk implementation

# Integration with legacy systems

## Mid-Level Integration

- Access data through Tsunami infrastructure
- Legacy viewers are now interact collaboratively
- Still maintain the option to interact directly with the data source
- Provides additional options for extending system capabilities

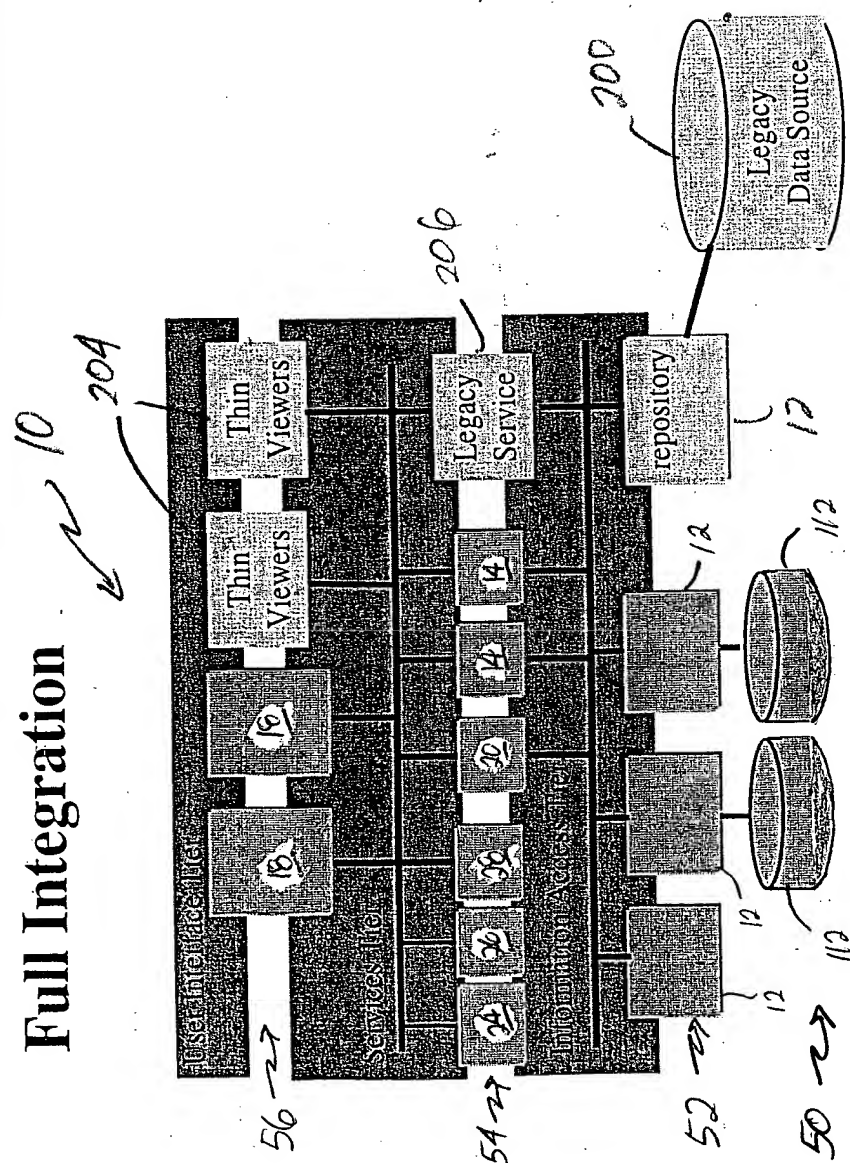


SYSTEM Infrastructure Legacy System

FIG. 13 is a block diagram of a system architecture for integrating legacy systems with modern applications. The diagram shows a multi-tier architecture. At the top, there are 'Thin Viewers' (10) which interact with a 'User Interface Layer' (56). Below this is a 'Services Layer' (54) containing various service components (12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100). These services interact with an 'Information Access Layer' (52) which connects to a 'repository' (50). The repository is linked to a 'Legacy Data Source' (200) via a 'Legacy Service' (206). The entire system is labeled 'Full Integration' (10) and 'SYSTEM Infrastructure Legacy System' (204).

# Integration with legacy systems

Full Integration



- Rewrite viewers in Java making them web-enabled and machine independent
- Legacy processing becomes a system component available for enterprise usage
- Lowers maintenance cost
- Duplicate functionality removed across the enterprise
- Each enhancement is available to the entire enterprise

SYSTEM Infrastructure Legacy System

Fig. 13

# *Importance of Data-Centric Collaboration Framework*

---

- Framework is applicable to most domains
- Small tools extend overall capability
  - Build domain or analyst specific tools--not systems
  - Adding single collaborative capabilities results in exponential growth of overall system capability
- Collaboration integral to framework
  - Instead of pasting images onto a whiteboard, collaborate on the tool itself using whiteboarding layer
  - No special logic needed in tools to support collaboration
- Supports legacy applications
  - Data is shared and not replicated, so changes to the data by legacy tools propagate to collaborative tools.

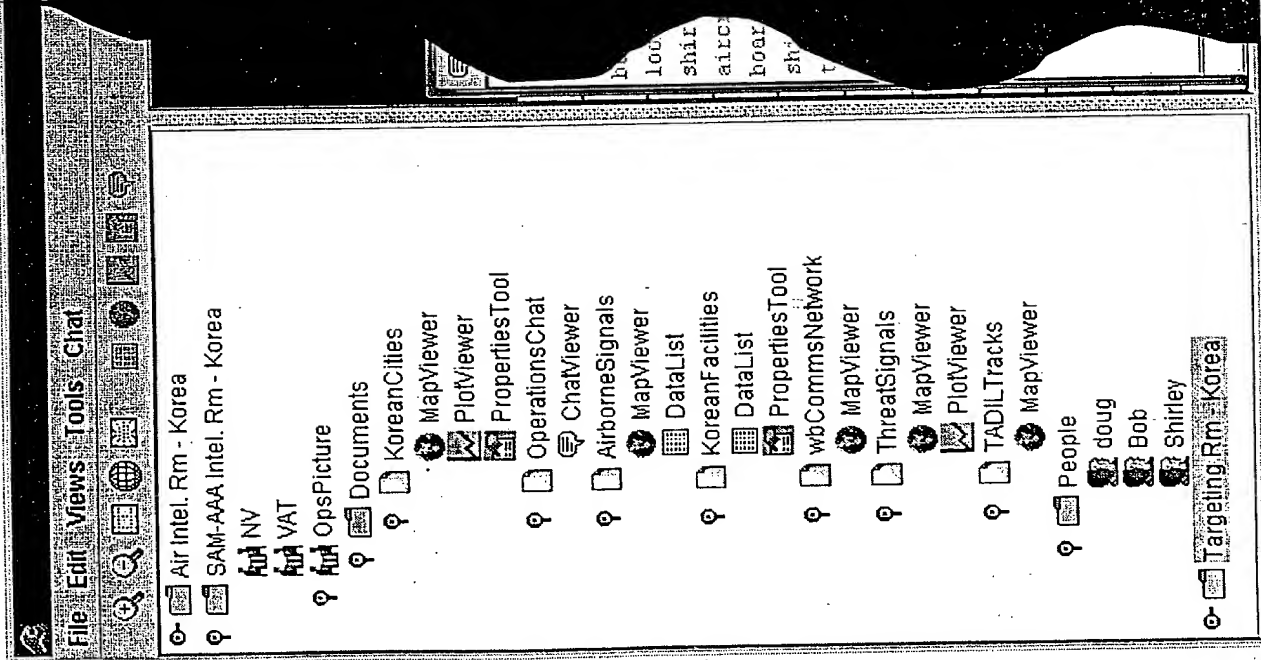
# Collaboration Application Management

The screenshot displays a complex web-based interface for managing collaborative data. The interface is divided into several sections:

- Top Navigation Bar:** Includes menu items like File, Edit, Views, Tools, and Edit.
- Left Sidebar:** Contains a list of users and roles, including SAM-AAA Intel, Rm - Korea, NV, VAT, OpsPicture, Documents, ThreatSignals, AirborneSignals, TADIL Tracks, KoreanFacilities, KoreanCities, wbCommsNetwork, OperationsChat, People, doug, Bob, Shirley, Air Intel, Rm - Korea, and Targeting Rm - Korea.
- Main Content Area:**
  - OpsPicture - AirborneSignals - DataList:** A table with columns for Signal Mod, Carrier Freq, Sequence, Carrier Freq, and Fundame. It lists several signal entries with their respective frequencies and sequence numbers.
  - OpsPicture - TADIL Tracks - DataList:** A table with columns for TRACKNO, TRACKDES, LATITUDE, LONGITUDE, and ALTITUDE. It lists several track entries with their respective coordinates and altitudes.
  - OpsPicture - ThreatSignals - Plot:** A graphical representation of threat signals, showing a network of interconnected nodes and lines, with labels like Sig-64, Sig-67, Sig-76, Sig-79, Sig-63, and Sig-75.
  - OpsPicture - ThreatSignals - Plot:** A line graph showing signal intensity over time, with a y-axis labeled 'Signal' and an x-axis with values 26, 28, 30, 32, 34, 36, 38.
  - OpsPicture - OperationsChat - ChatViewer:** A chat window displaying messages from users like shirley, bob, and TADIL, discussing network status and fighter activity.

Fig. 15

# Collaborative Application Management



- Multiple Active Rooms/Places that contain Documents, People, Tools and Conferences
- Within a Conference a person or group of people analyze information and interact to solve problems
- People within a Conference are shown
- Documents being used within a Conference are shown
- Tools that are connected to documents are shown
- User can minimize/maximize/remove individual tools, tools associated with a conference or tools associated with a room
- Documents are dragged and dropped onto a conference from the document server window

# Dynamic Repository Query & Document Management

- Dynamically learns about repository
- Gets attribute meta-data from repository
- Creates agent representing standing query
- Results become a document which may be used for collaboration

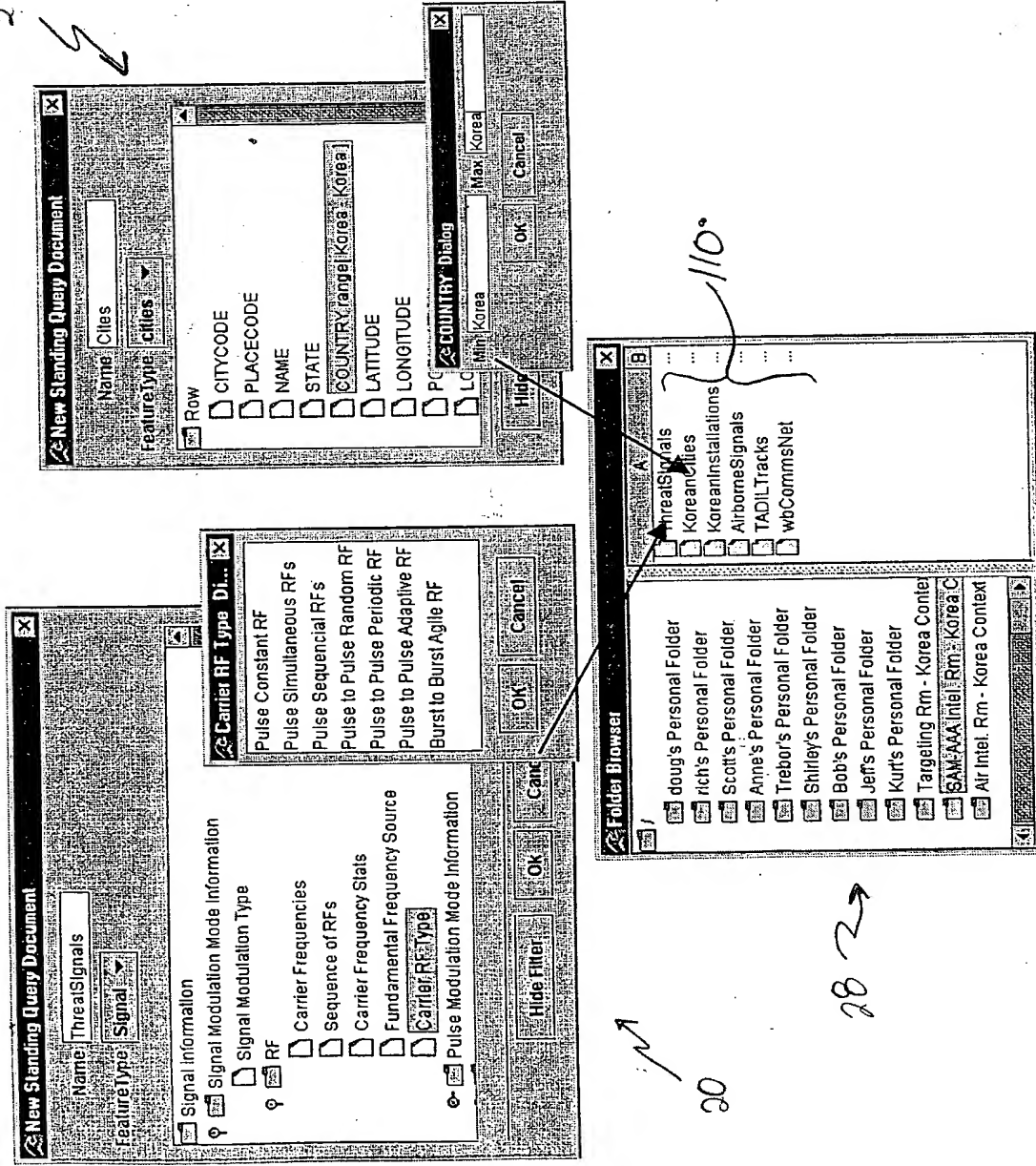


Fig. 17

# Map And White-Board

## Interaction

- The BBN Open Map Viewer was selected since it supported layering and a standards-based interface. No license fee is required. It is an Open Source component.
- A Mercator projection is shown with items colored via the data model
- A configurable pop-up menu can be seen
- Integration with commercial and legacy map products is based on OpenGIS standard APIs.

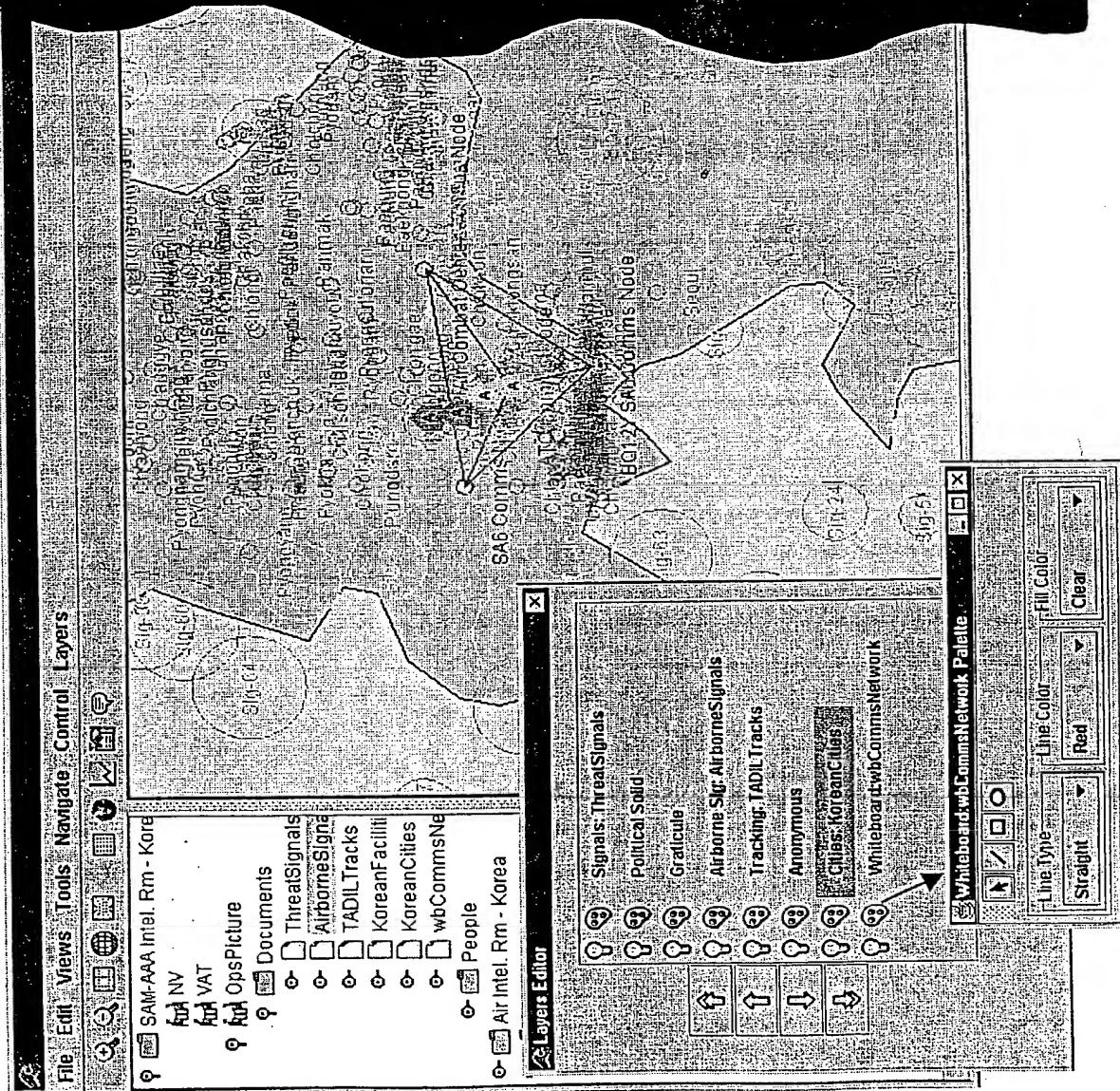


Fig. 18

# Extended Properties Editor

- Dynamically learns information schema from repository
- Attaches extended properties to data in the data channel
- Applied rules run as agents within the channel
- Extended Properties
  - Color
  - Highlight
  - Visibility
  - Label
  - Symbol
  - .....

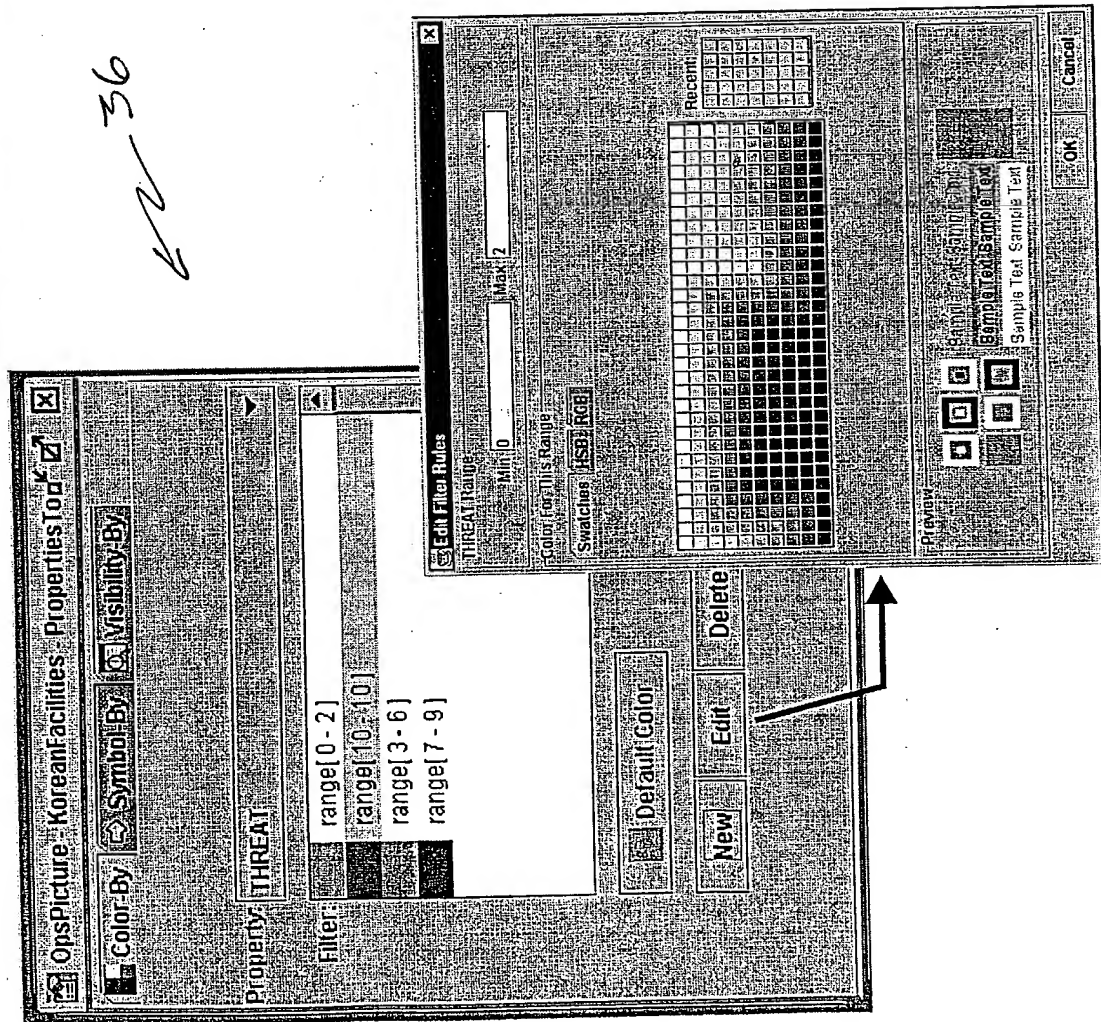


Fig. 19

# X-Y Plotter

- Select X and Y Attributes From List provided by Repository
- Re-order displays
- Zoom/Pan in any display independently or dependently

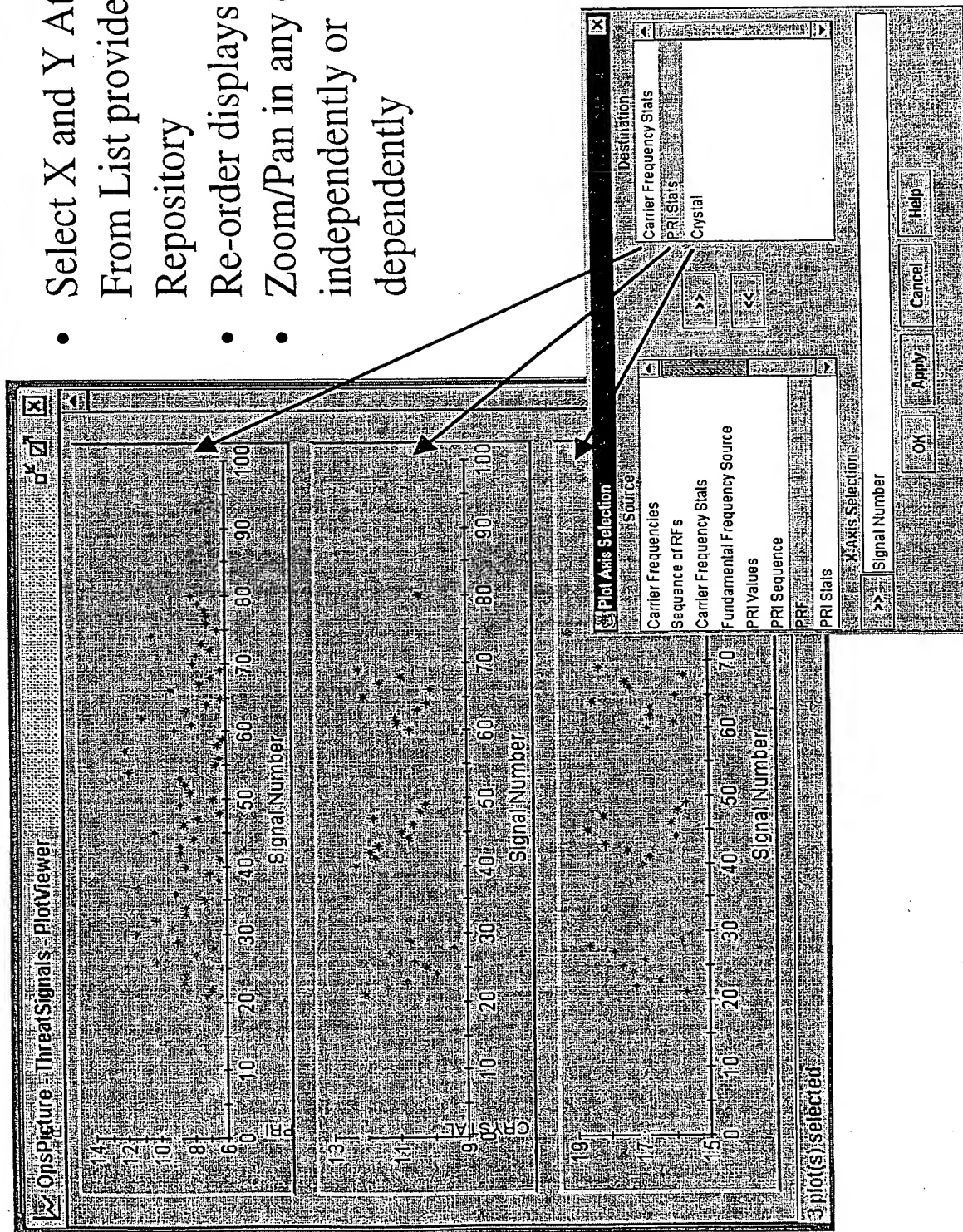


Fig. 20

# List Viewer

- Sorting
- Row Selection
- Row Coloring
- Row Hiding
- Choose Attributes to View

OpsPicture - KoreanFacilities - DataList					
SITECODE	NAME	COUNTRY	LATITUDE	LONGITUDE	THREAT
KN000097	Chunju	KN	38.433333	127.00	3
KN000561	Chilae	KN	38.466667	127.05	8
KN000017	Paibong	KN	39.416667	127.066667	4
KN00492	Chonmuk	KN	39.433333	127.066667	5
KN00228	P'yongsan	KN	39.233333	127.1	0
KN00380	P'yongpuk	KN	39.983333	127.333333	4
KN00227	P'yongsan	KN	39.966667	127.666667	6
KN00241	Paean	KN	39.683333	127.183333	5
KN00242	Pabawi	KN	39.683333	127.183333	1
KN00296	PaekKong	KN	38.466667	126.566667	1
KN00478	Changnye	KN	39.466667	126.566667	2
KN00292	Paekmyad	KN	37.95	126.583333	6
KN00425	Chaeon	KN	37.833333	126.6	2
KN00257	Paego	KN	38.433333	126.6	1
KN00521	Chapong	KN	39.366667	126.6	2
KN000004	Paekmyad	KN	37.8	126.6	1
KN00030	Paekchon	KN	37.8	126.633333	5
KN00019	Paekchong	KN	37.966667	126.633333	3
KN00323	Paekongbum	KN	37.933333	126.65	1
KN00493	Changhae	KN	37.883333	126.666667	4
KN00195	P'yongchae	KN	37.916667	126.666667	4
KN00015	Chonmuk	KN	37.05	126.666667	1

# Chat Tool

- Chat supports multi-user conversations from multiple conferences in multiple contexts
- People connect to a document and communicate
- People in the same conference see the same visualization properties like color and visibility of participants inputs
- Conversations are persistent over time

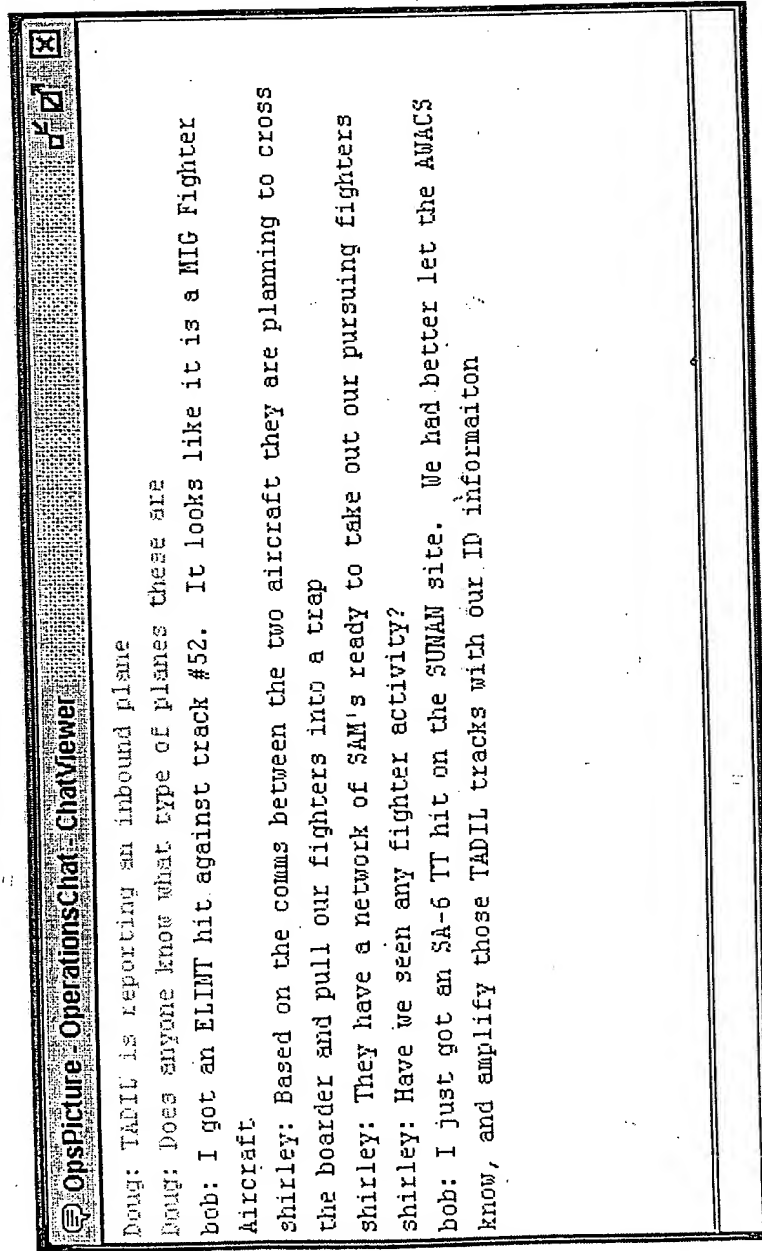


Fig. 22

Figure 23: Performance Metrics. This diagram illustrates the system architecture and performance metrics for a collaborative environment. The system is divided into three main functional areas: Information Services, Information Services, and Information Services. The Performance Metrics section details the time taken for various operations, such as Login, Desktop, Join Context, Query & Create Doc, and Chat. The Information Services section lists the components involved, including Participant Server, Context Server, Document Server, Map Viewer, List Viewer, X-Y Viewer, Chat Viewer, Chat Data Channel, Signal Data Channel, Cities Data Channel, Signal Repository, Cities Repository, and Cities Database. The Information Services section lists the components involved, including Participant Server, Context Server, Document Server, Map Viewer, List Viewer, X-Y Viewer, Chat Viewer, Chat Data Channel, Signal Data Channel, Cities Data Channel, Signal Repository, Cities Repository, and Cities Database.

# Performance Metrics

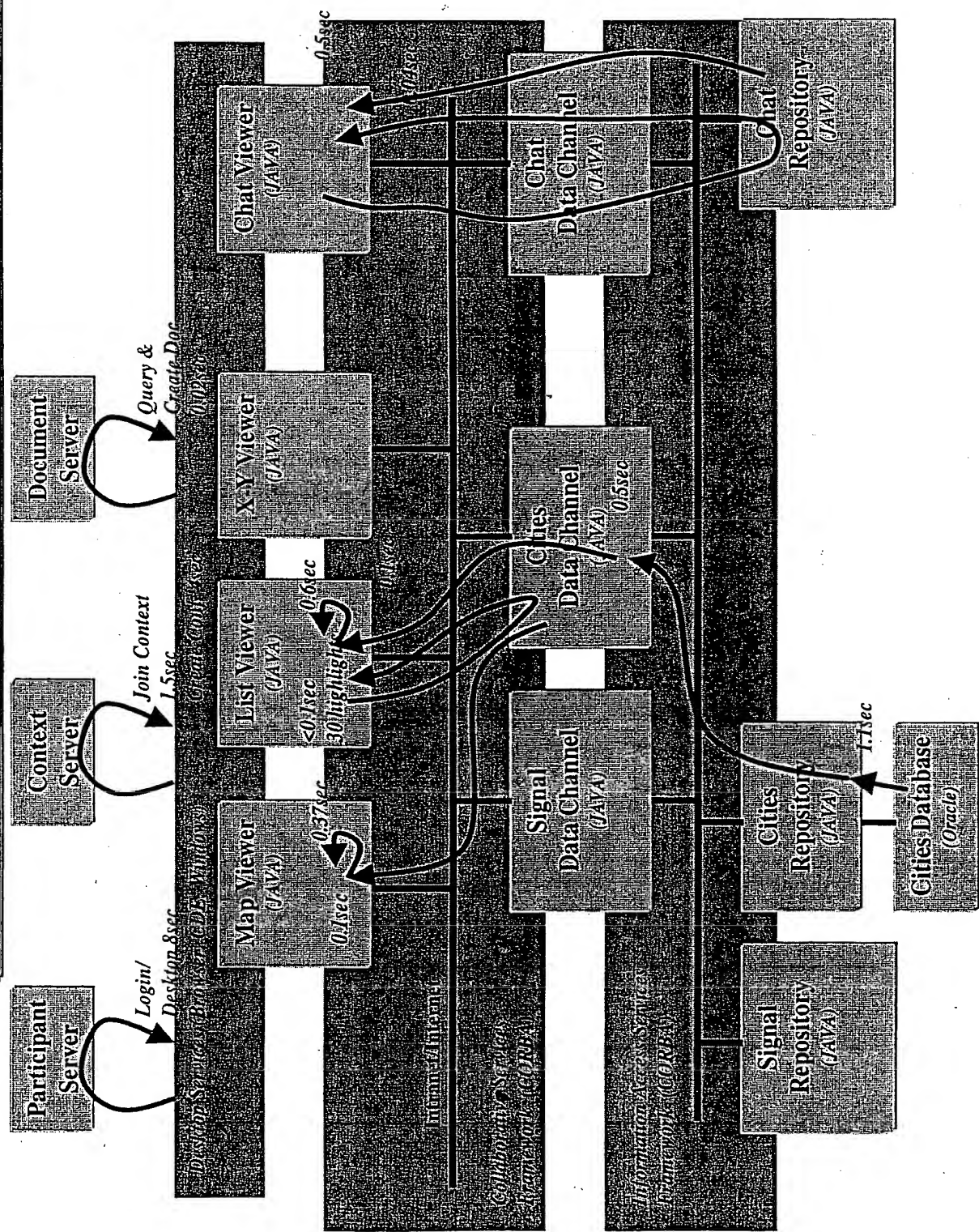
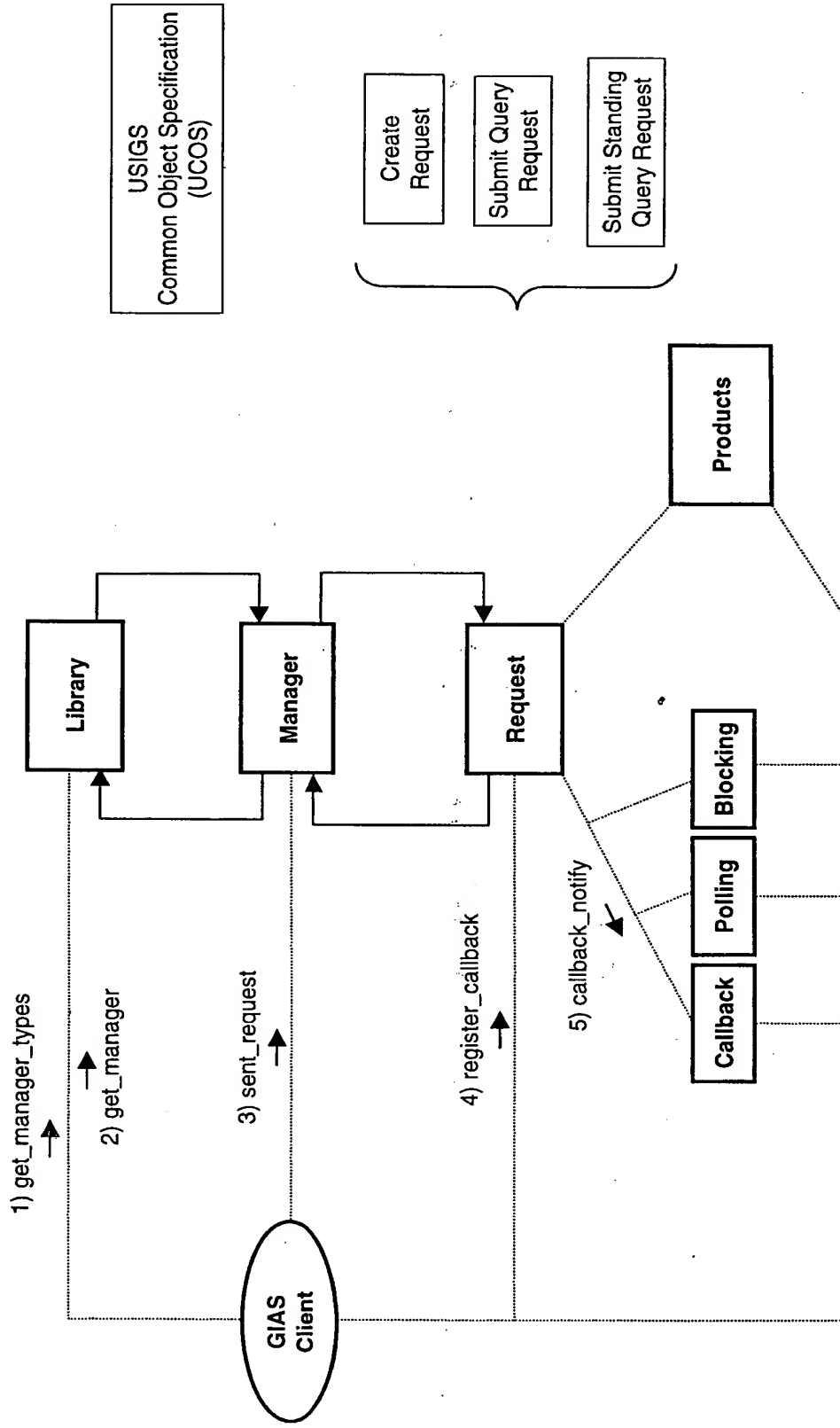


Fig. 23

# USIGS - Geospatial and Imagery Access Services Specification



- Dynamic discovery of information sources
- Dynamic discovery of access techniques
- Synchronous, Asynchronous, Polling Access mechanisms
- Clients autonomous request executing within the data environment
- All Interfaces and Structures represented within IDL (UCOS - DAG)

# Information Access Services

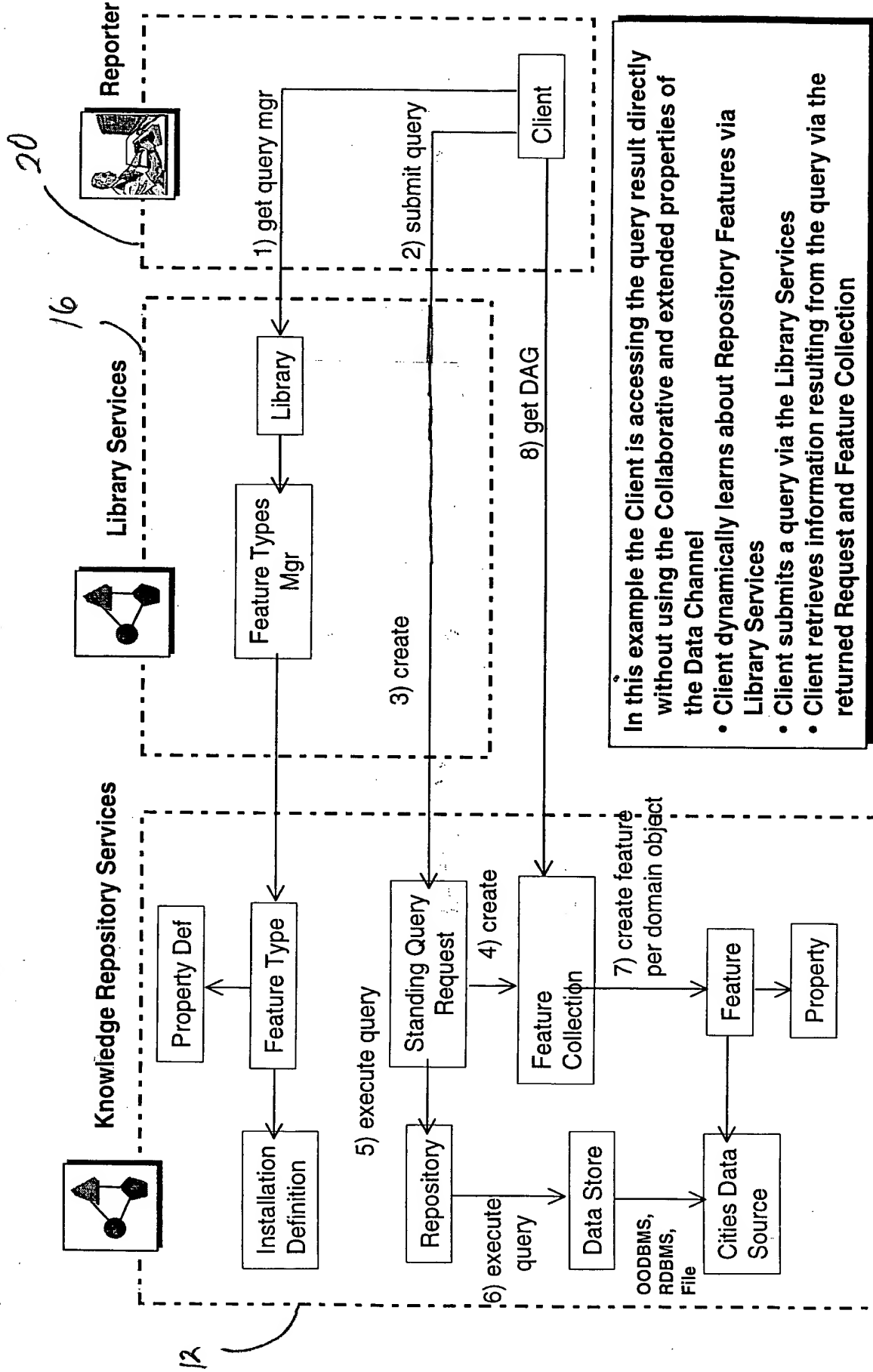


Fig. 25

# Library Virtual Access

## Requesting Information

- Client knows only about Library
- Client learns about Feature Types through Feature Type Mgr
- Client submits query through the Standing Query Mgr
- Repository and Feature Collection adapt to Database Particulars

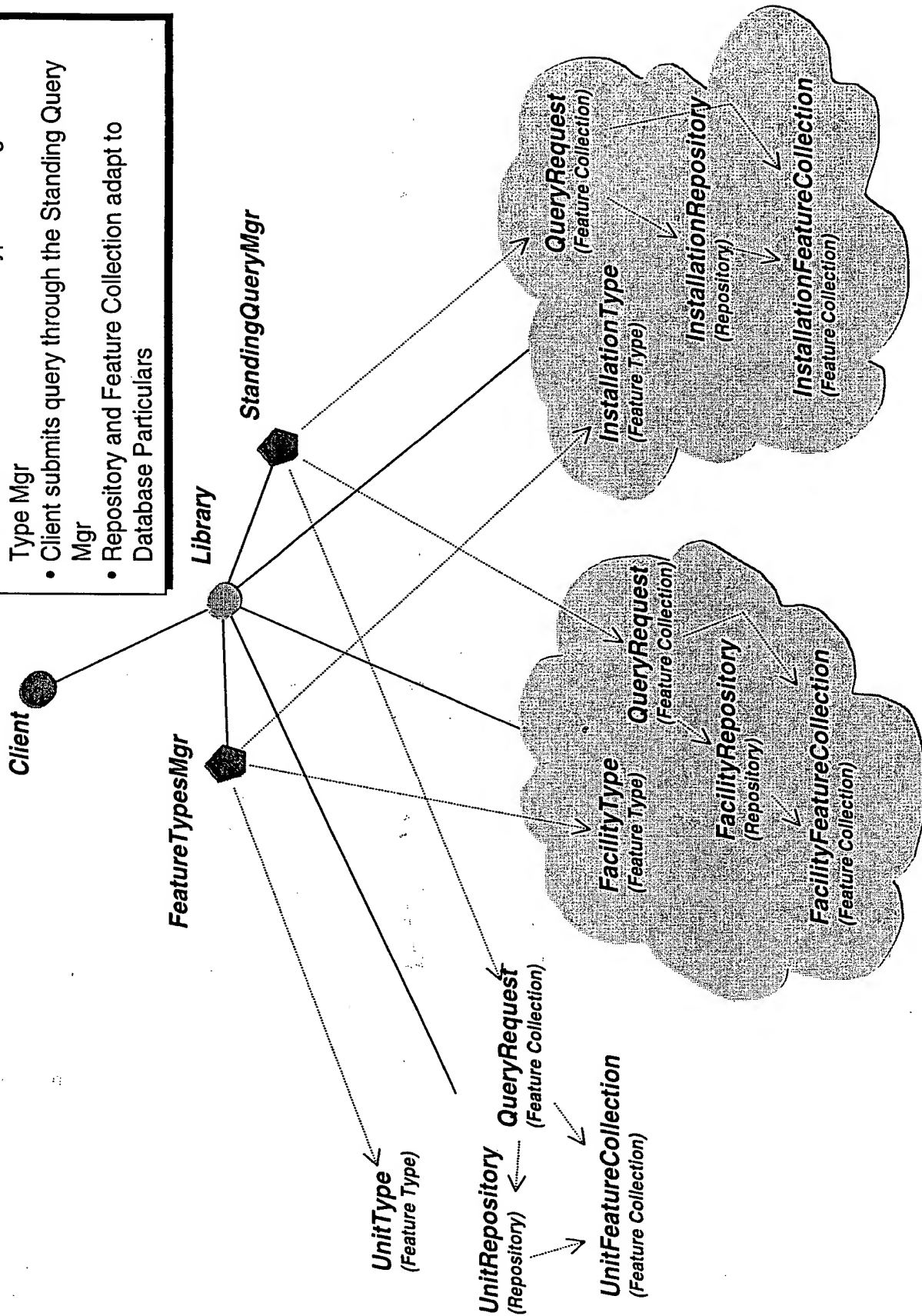
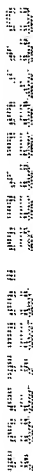


Fig. 26

$\frac{d}{dt} \left( \frac{\partial L}{\partial \dot{x}} \right) = \frac{\partial L}{\partial x}$

$\frac{d}{dt} \left( \frac{\partial L}{\partial \dot{x}} \right) = \frac{\partial L}{\partial x}$



- $\frac{d}{dt} \left( \frac{\partial L}{\partial \dot{x}} \right) = \frac{\partial L}{\partial x}$

[illegible]

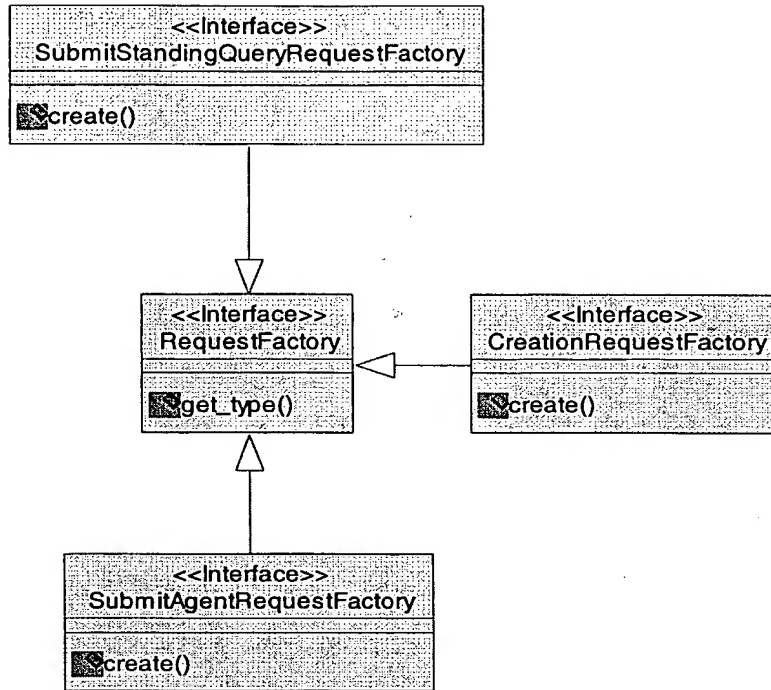


Fig. 28

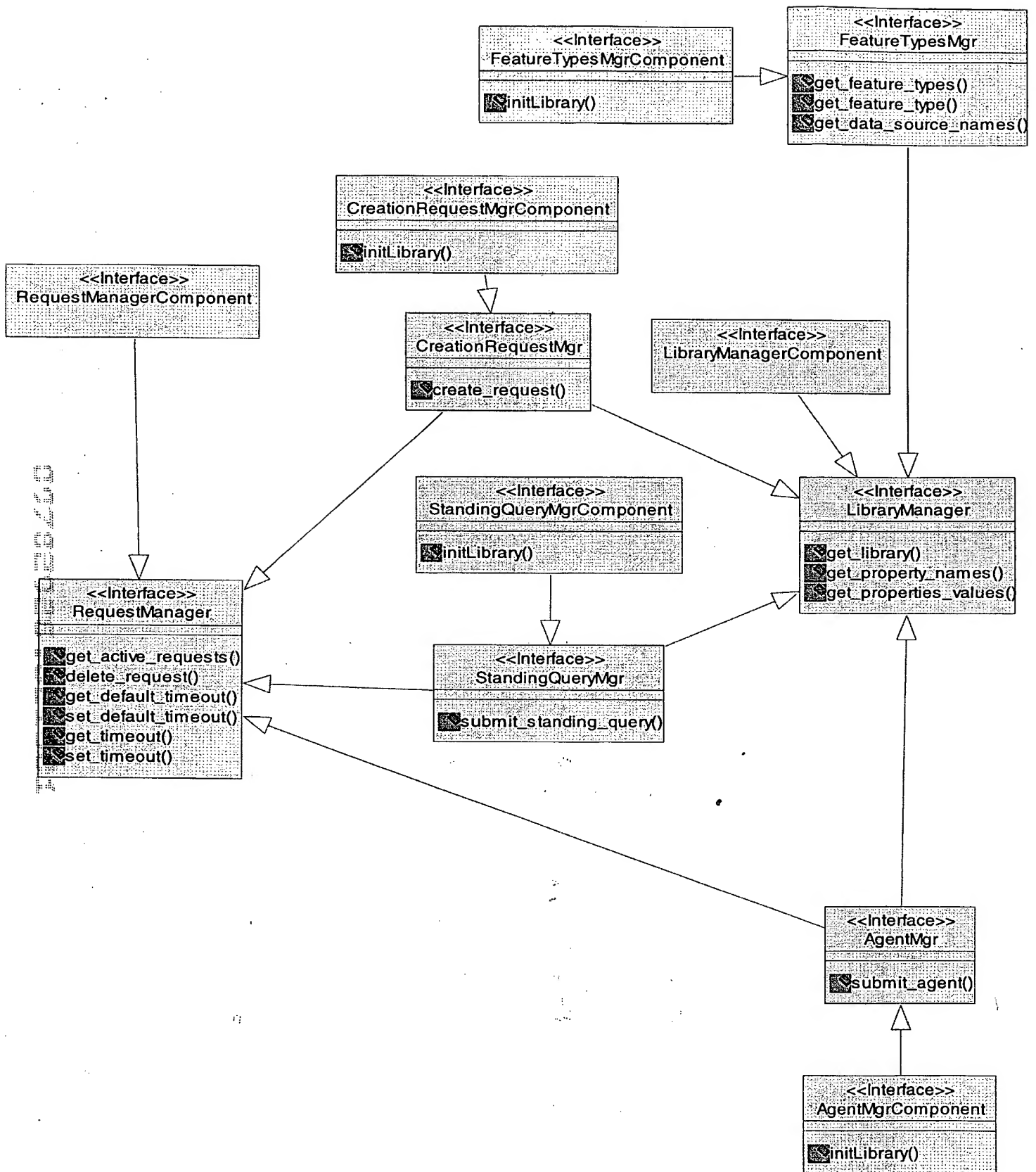


Fig. 29

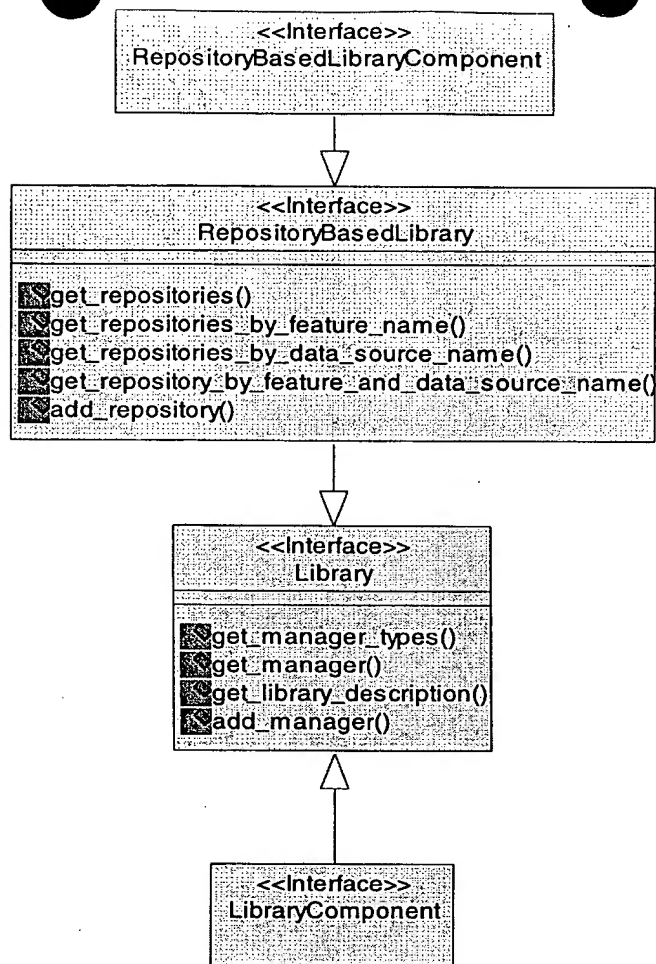


Fig. 30

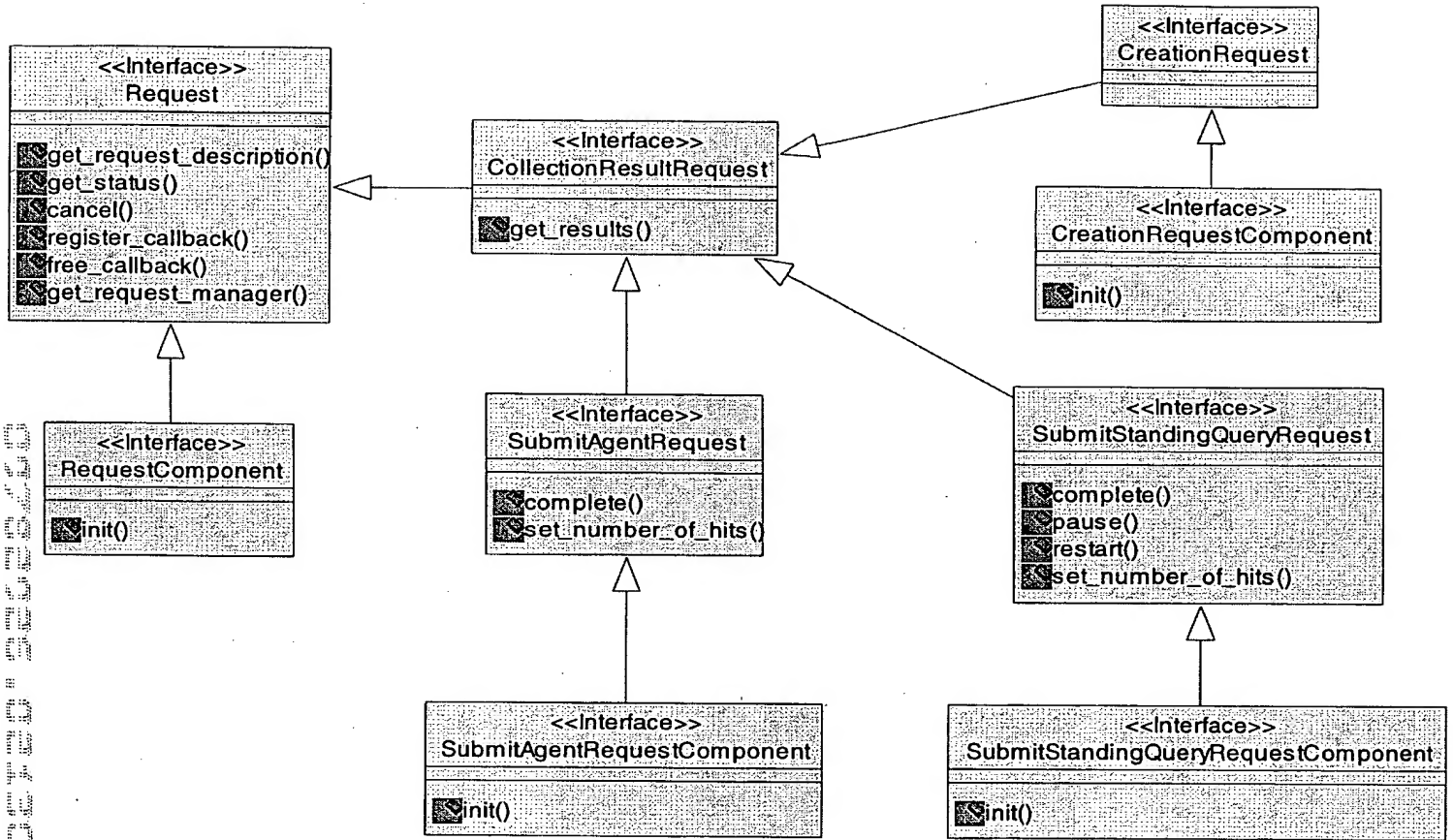


Fig. 31

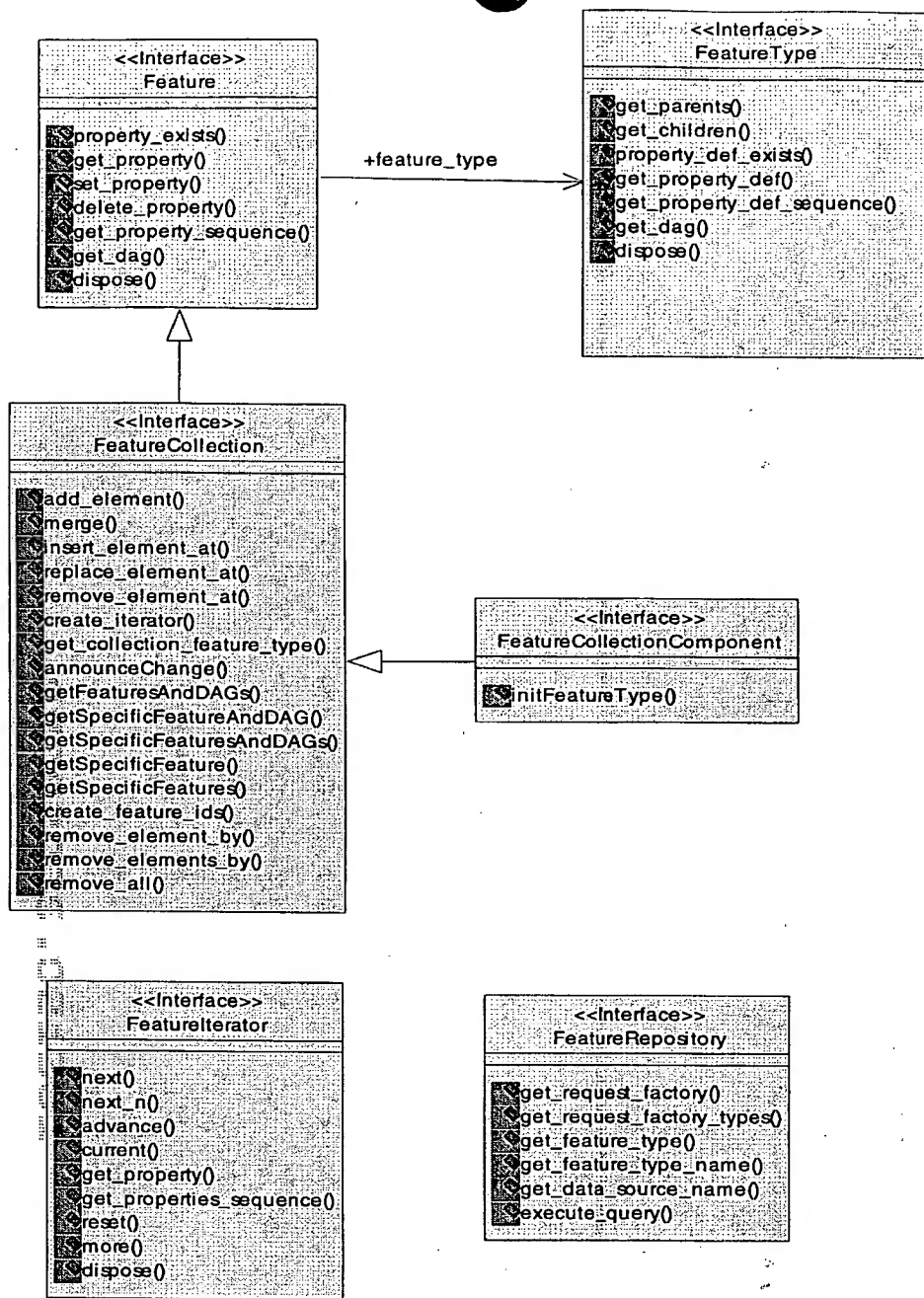


Fig. 32

# Data Channel Services Framework

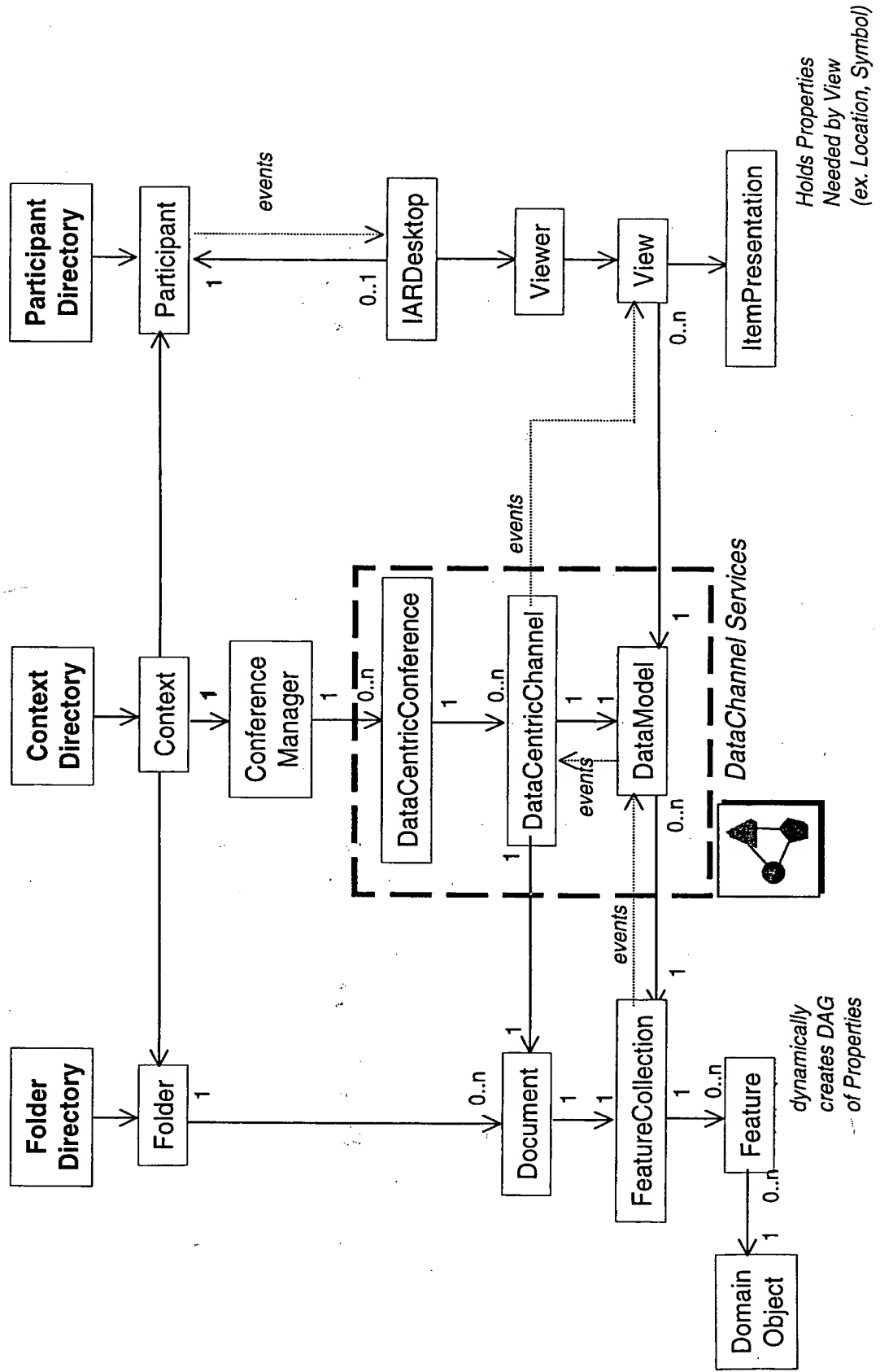


Fig. 33

# Versioning Data Changes in the Data Channel

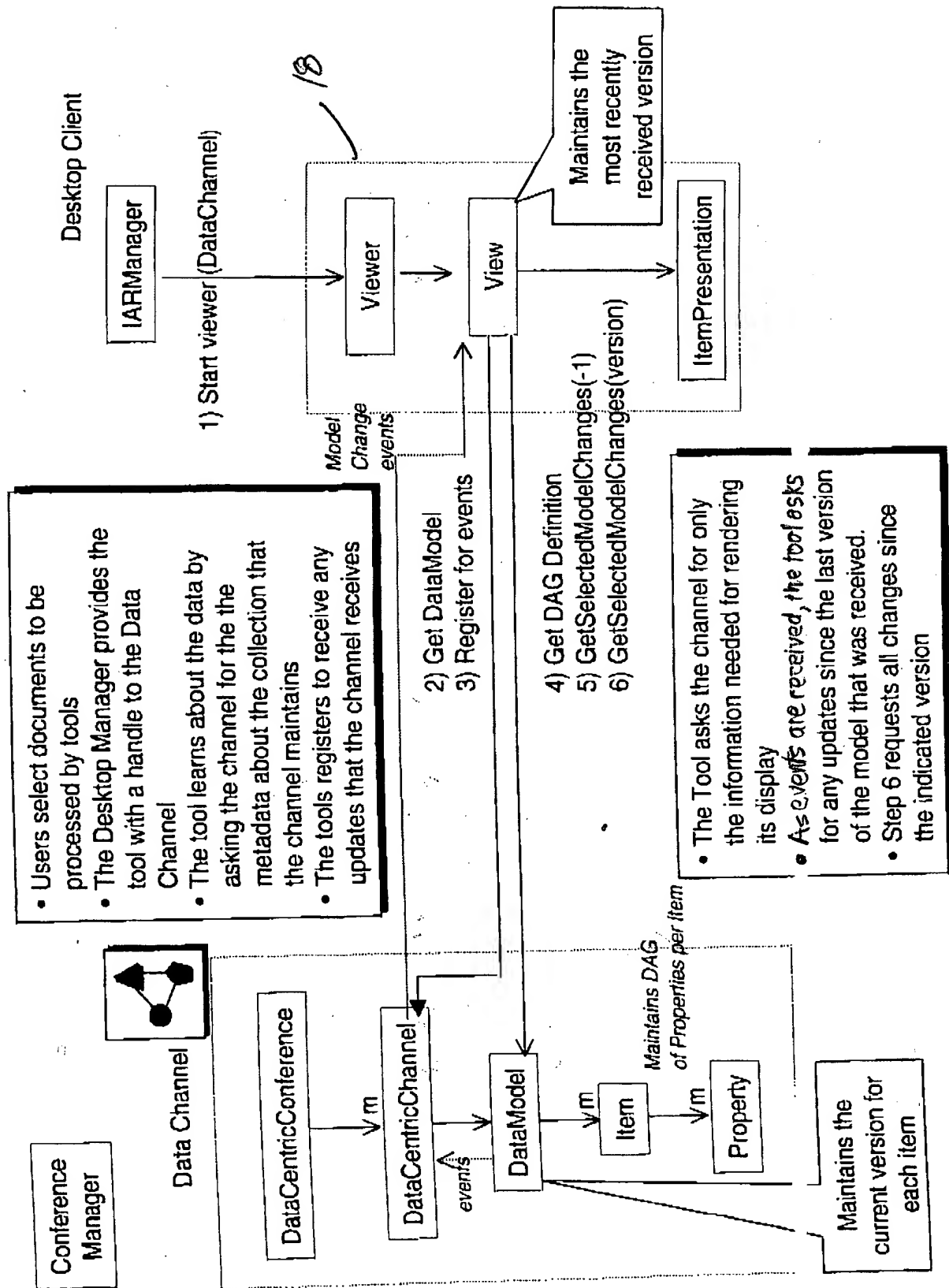


Fig. 34

# OpenGLS Simple Features Specification

## Understanding a Feature Collection

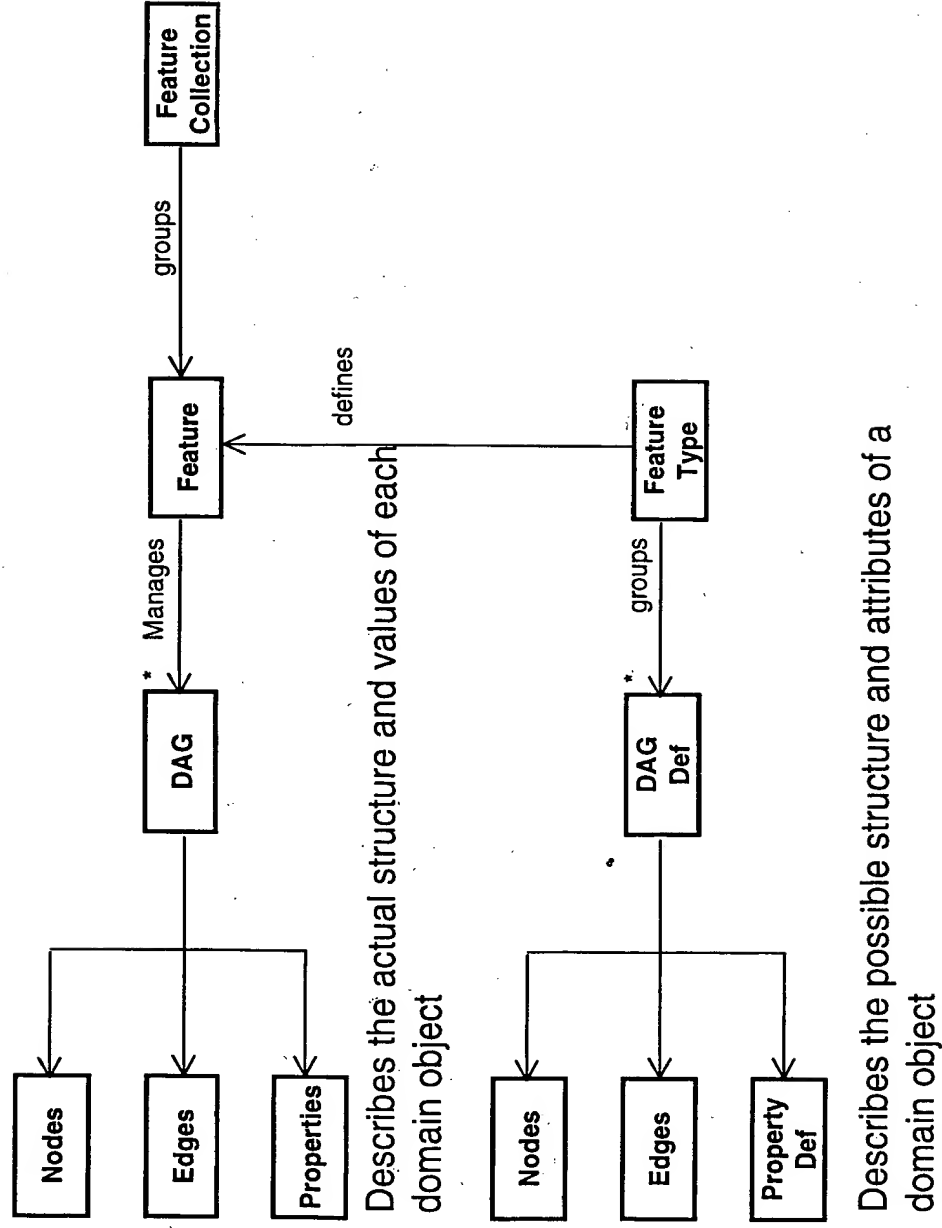


Fig. 35

# Directed A-Cyclic Graph (DAG)

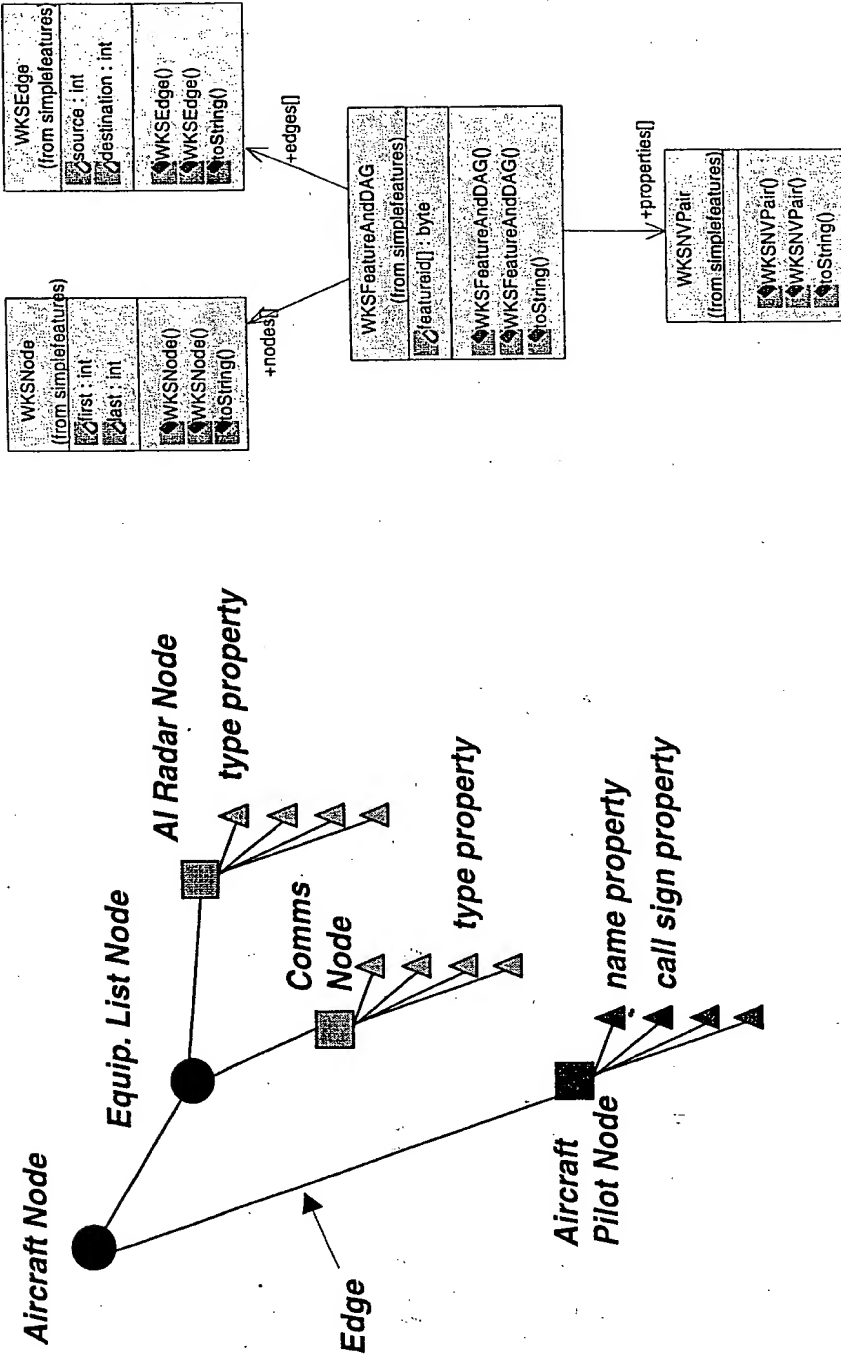


Fig. 36

# Directed A-Cyclic Graph (DAG)

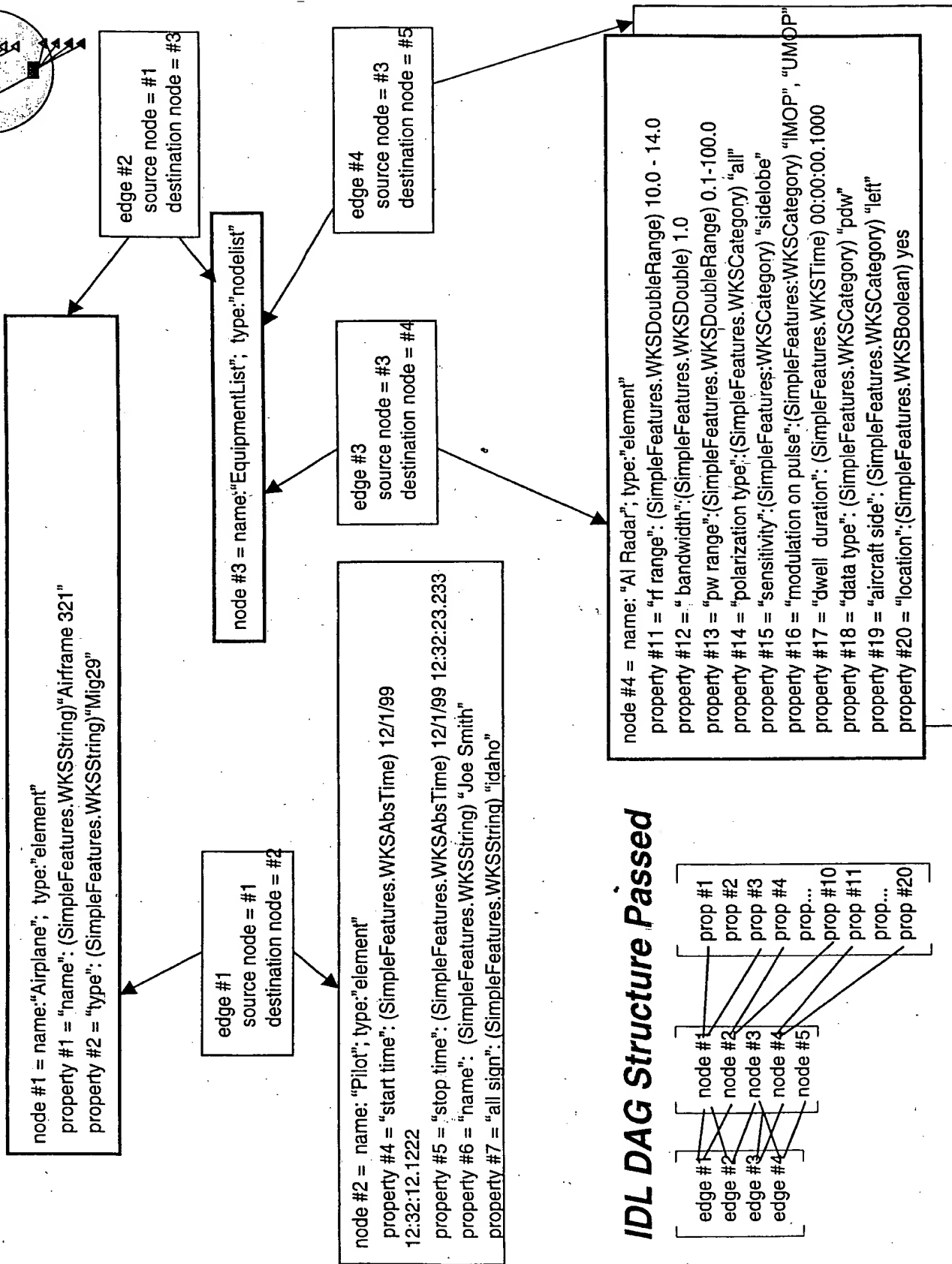


Fig. 37